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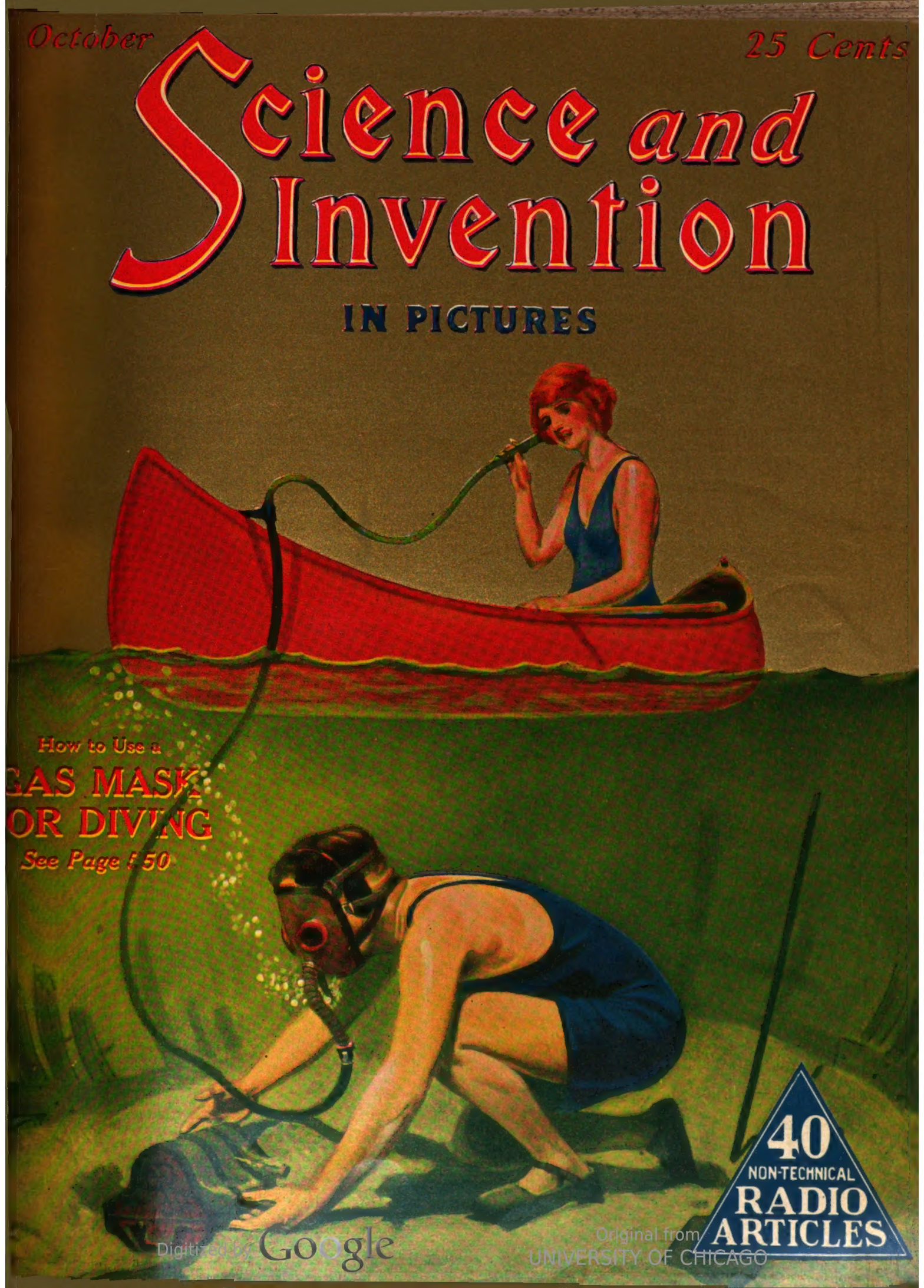

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40 NON-TECHNICAL RADIO ARTICLES

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Vol. XII.
Whole No. 138

Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

October, 1924
No. 6

Member Audit Bureau of Circulations

EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City
Published by Experimenter Publishing Company, Inc. (H. Gernsback, Pres.; S. Gernsback, Treas.; B. W. DeMott, Sec'y).
Publishers of SCIENCE AND INVENTION, RADIO NEWS, PRACTICAL ELECTRICS and MOTOR CAMPER & TOURIST.

Table of Contents for October

POPULAR SCIENTIFIC ARTICLES

EDITORIAL.....By H. Gernsback 547
THE PYRAMIDS TELL TIME.....By L. B. Robbins 548
HUDSON RIVER TUNNELS MEET...By W. B. Arvin..549
WAR GAS MASKS AS DIVER'S HELMETS..... 550
By Joseph H. Kraus
THE SCIENCE OF ATHLETICS.....By R. Leon Hall 551
UNIQUE CLOCKS.....By Marshall Kelly 552
WHAT WOULD HAPPEN IF THE EARTH SLOWED DOWN .....By Cleve Hallenbeck 553
THE LIVING DEATH.....By J. Martin Leahy 554
DR. HACKENSAW'S SECRETS...By Clement Fezandie 556
SCIENTIFIC INNOVATIONS..... 558
OUR SUN IS A PYGMY.....By Charles H. Howard 559
MAGIC FOR EVERYBODY..By Prof. Joseph Dunninger 560
MEDICAL SPECIALIST BROUGHT TO EVERY TOWN 561
INGENIOUS DRIVER'S TEST..... 561
By William Middleton and J. G. Pratt
CRACKING DAVY JONES' LOCKER..By H. W. Secor 562
GAMBLERS' TRICKS EXPOSED.....By Mark Mellen 564
POISONS WE EAT EVERY DAY..... 565
THE HEAVENS IN OCTOBER..... 566
By Isabel M. Lewis, M.A.
CASEIN AND ITS USES.....By Raymond B. Wailes 567
WATER TRANSPORTATION.....By Jack Bront 568
SCIENTIFIC TUMBLER TRICKS..By Walter B. Gibson 570
CONCRETE BRIDGE HAS OSCILLATING PIERS.... 571
MAKING A KITCHEN CABINET..... 572
By William Butterfield
MACHINE PICTURES SOUND.....By C. A. Oldroyd 573
STEREOSCOPIC PORTRAIT CAMERA..... 574
THE BODY AS AN AQUARIUM..... 575
SHADOWS THAT STAY..... 576
TENT FIRE-PLACE..... 577
WHERE IS THE MOON THE BIGGEST..... 578
ARE YOUR CLOTHES MADE OF GOOD MATERIAL? 579
By Ismar Ginsberg, B.Sc., Chem. Eng.
READERS' FORUM..... 508
DISAPPEARING SEARCHLIGHTS..... 581

PRIZE CONTESTS

AWARDS OF THE $1000 MONTHLY PRIZES..... 602
HOW-TO-MAKE-IT DEPARTMENT—$30.00 IN PRIZES 585
SCIENTIFIC HUMOR—PRIZES FOR BEST JOKES 597

AUTOMOBILES

VULCANIZER 585
INGENIOUS DRIVER'S TEST..... 561
HUDSON RIVER VEHICULAR TUNNEL..... 549

ELECTRICITY

ELECTRIC ANCHOR HOIST..... 569
NERVE ANALOGY..... 574
DISAPPEARING SEARCHLIGHTS..... 581
ELECTRIC SURFACER..... 577
LIE DETECTOR..... 568

RADIO ARTICLES

LOCATING ORE BY RADIO..... 587
RADIO NEWS HERE AND THERE..... 588
NEW YORK GETS NEW BROADCASTER..... 589
CRYSTODYNE 590
LADDER OF VIBRATIONS..... 591
COMPLETE DATA ON RADIO TUBES..... 591
THE SOLODYNE..... 592
THE JOLLIFFE RECEIVER..... 593
UV-199 AUDIO FREQUENCY AMPLIFIER 593
RADIO ORACLE 594
COMPLETE LIST OF BROADCASTING STATIONS WITH POWER AND WAVE-LENGTH..... 625

CONSTRUCTOR ARTICLES

SWINGING BRIDGE 577
SIMPLE AND EFFICIENT MOTOR LAUNCH..... 582
PLASTER MASKS..... 583
COMPASS ATTACHMENT 583
ROCKING SHIP WINDOW DISPLAY..... 584
PHOTOGRAPHIC STUNTS 584
HOW-TO-MAKE-IT DEPARTMENT..... 585
WRINKLES, RECIPES AND FORMULAS..... 586
Edited by S. Gernsback

CHEMISTRY ARTICLES

POISONS WE EAT EVERY DAY..... 565
CASEIN AND ITS USES.....By Raymond B. Wailes 567
ARE YOUR CLOTHES MADE OF GOOD MATERIAL? 579
SUN FLOWER USES..... 578

ASTRONOMY ARTICLES

THE PYRAMIDS TELL TIME..... 548
OUR SUN IS A PYGMY!..... 559
THE HEAVENS IN OCTOBER..... 566
By Isabel M. Lewis, M.A.
WHEN IS THE MOON THE BIGGEST?..... 578
By C. A. Dahama
MERCURY'S LANDSCAPE..... 581

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SCIENCE AND INVENTION is published on the 25th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., Inc. If you change your address notify us promptly, in order that copies are not miscarried or lost.

All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 53 Park Place, New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable. SCIENCE AND INVENTION, Monthly. Application as second class matter made at New York, N. Y. with additional entry at Long Island City, N. Y. Post Office, under act of Congress of March 3, 1879, formerly entered at Jamaica, N. Y. Title Registered at the Patent Office. Copyright, 1924, by E. P. Co., Inc., New York. The Contents of this Magazine are copyrighted and must not be reproduced without giving full credit to the publication.

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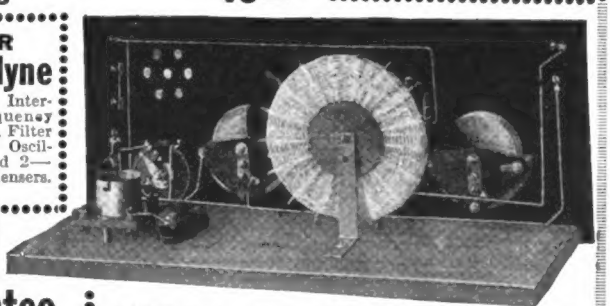

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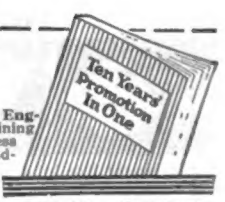

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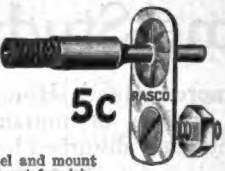

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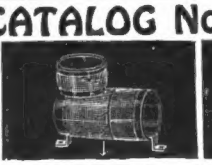

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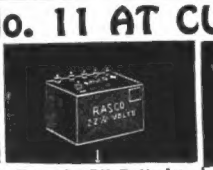

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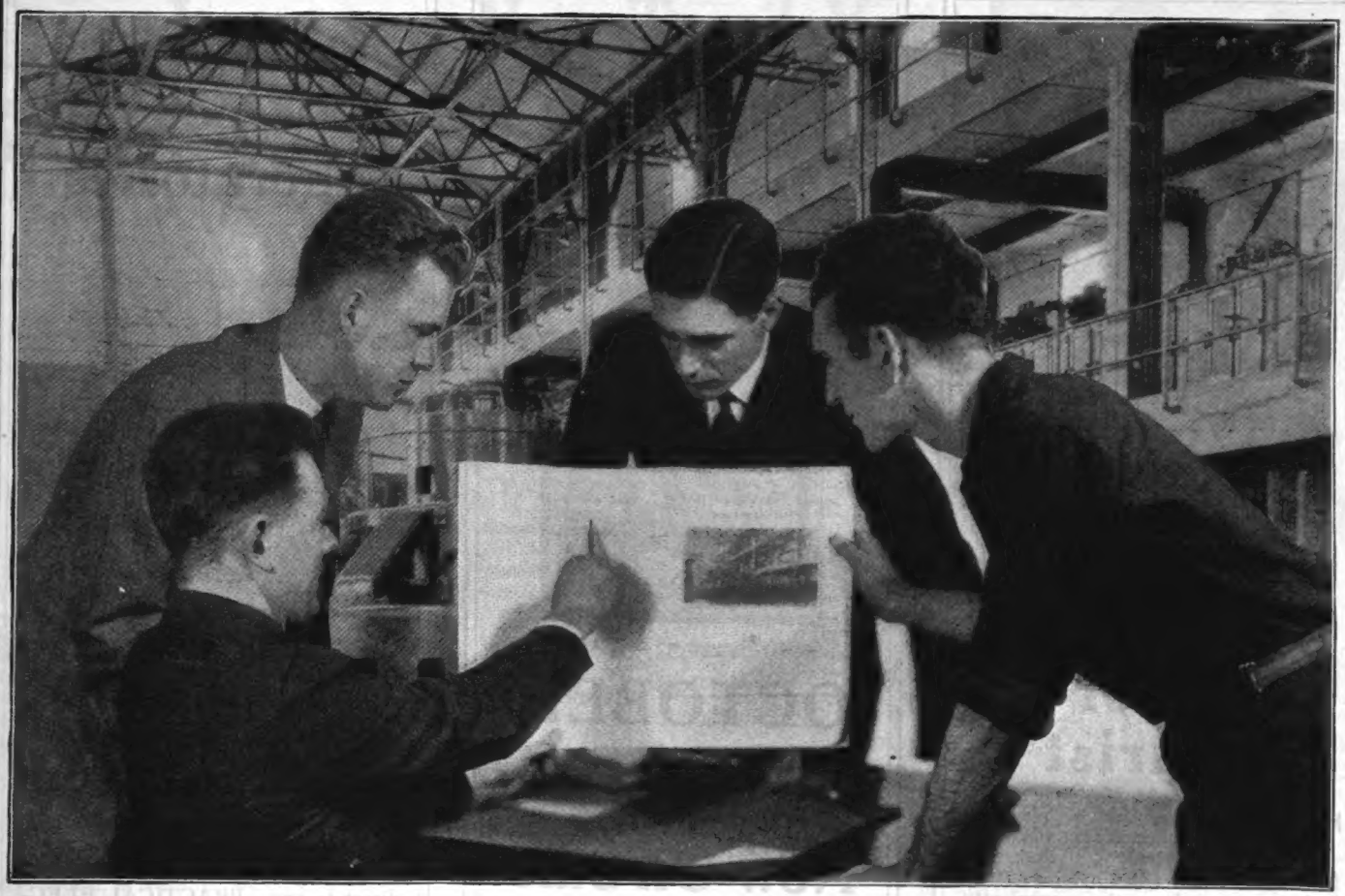

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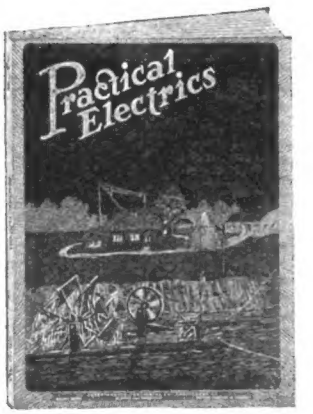

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Great Inventors Now Teach You Secrets of Practical Inventions

How would *you* like to be the inventor of the tin cap that now corks millions of bottles—and who gets a royalty on every one? How much money would *you* have now if you had invented the simple idea of putting a rubber tip on pencils? The inventor of the Gillette Safety Razor is said to have made as high as $2,500,000 *a year!* The inventor of the tiny snap fastener last year paid an *income* tax of $29,000. The man who invented the Autographic Kodak sold his patent rights for $500,000!

Little inventions like these have brought fortunes to their inventors

JUST a single idea can make *you* independently wealthy in a short time. Little things—like the crimped hairpin, the paper safety-match, the metal-tip shoelace—brought their inventors hundreds of thousands of dollars. Only recently *Success Magazine* told how one woman built up a splendid business from an invention based on a little wedge-shaped piece of wood!

Couldn't *you* develop an invention as simple as these? Haven't *you* some ideas—even now—for one of these little inventions which can pay you so much money?

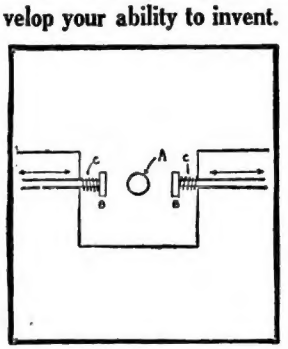
What Invention Is

After all, invention is nothing more than the science of "fixing things." And how many times a day you do "fix things." A leaky faucet, a rattling window, a broken strap — you fix hundreds of things just like these almost every day. You may not know it, but when you "fix things" you are using the principles upon which Inventive Science is based.

Prove it for yourself. Here is shown a very simple problem in invention. See how quickly you can solve it. What would you put on Shaft "A" to force members "B B" to move back? Think of something you know now which can give you the answer. If you have an ordinary electric light switch you will find it in a second.

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. The truth is that invention is based upon exact laws which anyone can learn. It is merely a matter of first *seeing* something to be fixed and then of thinking of some principle which will fix it.

This test shows how easily you can develop your ability to invent.



Here is an interesting little problem and its solution will be found very simple, if we really think hard.

"A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

That's all. The whole thing rests on being able to think inventively. The simple problem shown here proves that when you think inventively the whole science of invention becomes as easy to learn as reading or writing.

Why More Inventions Are Needed Now

Raymond F. Yates, who with fourteen other famous inventors now makes it easy for you to learn how to invent in your spare time at home.

Hundreds of years ago, the world didn't need many new things. That is why few inventions were made each year. But now the world has more needs, more things to be "fixed." And that is why, in the United States alone, over 50,000 inventions are patented every year!

The world wants better and cheaper light and power. It wants an electric light that will be heatless. It wants new motors that will weigh less and produce more power. It wants faster and less costly aeroplanes, motor cars, steam engines. It wants new inventions which will make cooking and housework easier; that will save time and labor in the home, the farm, the factory and the office. It wants new ideas for toys and other amusements. It wants its present inventions to be developed so that they will work better and more economically.

Surely you have at least one idea for an invention—no matter what it is—no matter how great or how small — the world will pay handsomely for even the simplest idea. Every day you see things which can be improved or which must be "fixed." Every day you can get ideas for new inventions. It can be a new kind of mechanical toy, or some device which will make your wife's housework easier. It can even be something as simple as the common nutcracker. The man who invented the Kiddie-Kar, it is reported, made over $5,000,000!

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, automobile mechanics, law, medicine, as a profession. The Bureau of Inventive Science offers you the first course in practical invention ever devised, it has written down the easy-to-learn principles of Inventive Science so everybody could read them and learn to use them. You want the ability to invent — NOW. All you need, to become successful is this easy, fascinating training which will develop your ability so it will be worth real money.

Learn Invention by Actual Practice at Home

Hitherto inventors had to work out the principles of invention alone. But at what a terrific price in long years of discouragement, lost time, wasted money! Now you can quickly learn, in your spare time at home, the secrets of invention which brought wealth and fame to Edison, Marconi and other great inventors.

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New FREE Book

The most fascinating part of this great new course is that it teaches invention by actual practice, right in your own home. With each lesson you are sent some problem in invention—just like the one you worked out here. This fascinating exercise in solving actual problems in invention, sharpens your instinct to fix things. Better than anything else, it gives you an unforgetable, instinctive habit of thinking inventively, which is worth more than you realize. In fact the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

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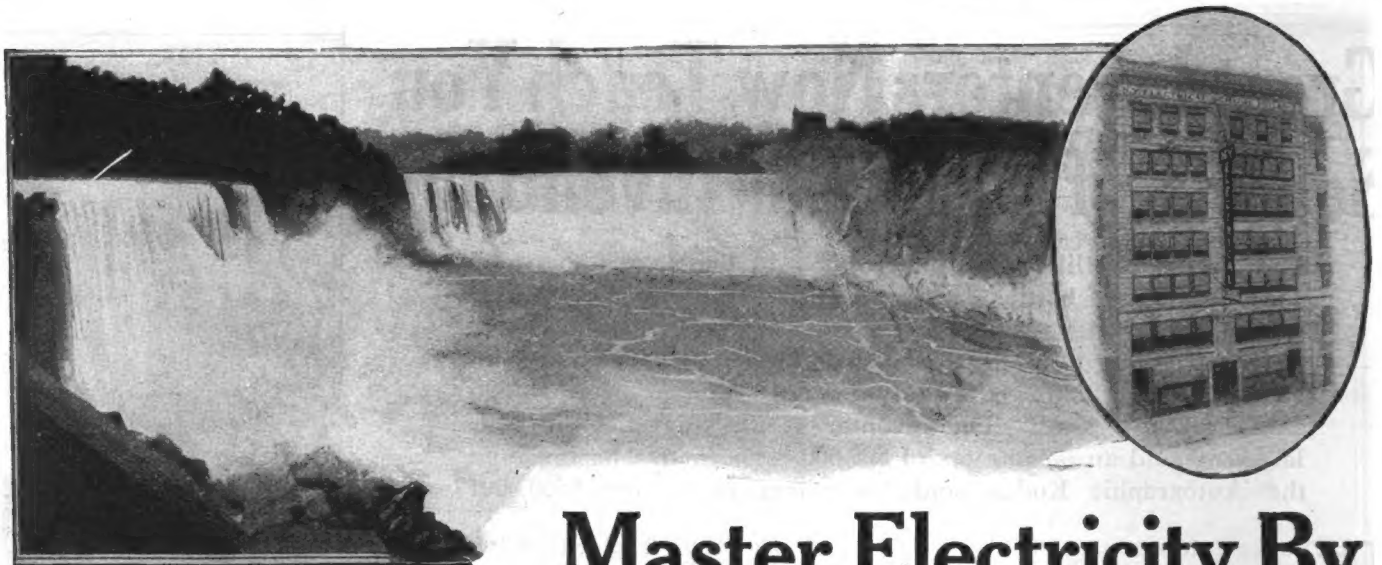

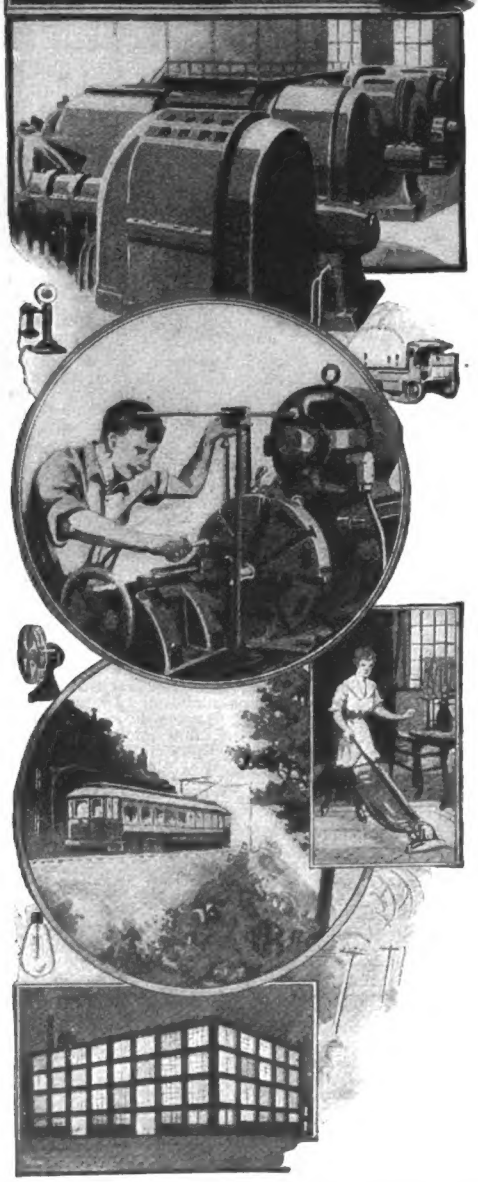

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Science and Invention

OCTOBER
1924
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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

Radio and Life

By HUGO GERNSBACK

WHENEVER there is a heavy continuous rain-fall in the country almost any farmer that you meet will tell you that he blames it all on the radio. Whether there is a cyclone, long extended rain, or, for that matter, a long extended drought or an earthquake, radio is sure to be blamed for the result. Of course scientists scoff at any suggestion that radio can have any effect whatsoever on rain or drought, but it is also true that radio waves no doubt have SOME effect on our atmosphere, but this effect may be compared with an electric fan in the midst of a prairie. The fan will make SOME breeze and create SOME disturbance, but the effect ten or fifteen miles away from the fan will be practically nil. So with radio.

I BELIEVE

¶ THAT Success comes to those who Think-Act, rather than Act-Think.

The entire power that is actually sent out into space all over this globe does not amount to more than 5,000 kilowatts, in other words, a power that would light about 100,000 fifty watt incandescent lamps. If in the future this power should amount to a million kilowatts or over there is no telling but that this power might actually have a slight effect upon our atmosphere, but even then it could never be serious enough to interfere with rain or sun. The super-radio station of the future—when we will send power by radio—and which may radiate into space 500,000 kilowatts will be quite a different matter. Such a super-station would probably keep the immediate vicinity free from rains if sufficiently elevated. It has been shown recently that aviators using electrified sand were able to disperse clouds and actually cut huge holes into cloud banks by this means. It would seem that future radio power stations might clear the air of rain, sleet or snow for possibly a few miles around, but even such huge stations will probably not affect the rest of the atmosphere to any marked degree.

I BELIEVE

¶ THAT fifty years hence, sunlight and ocean waves will supply the world's power.

The writer has often been asked "What effect do radio waves have upon the human body?" It is a fact that as you are reading these lines radio waves are passing through your body from all sides. No matter where you are these days radio waves of various frequencies will actually pass through your entire body almost every second of the day. If you are in the open, such waves will surge more strongly through you than when you are in the city. When you are standing alone on a prairie, you will possibly receive the maximum effect of the waves. If you are in the city, surrounded by tall steel buildings, these buildings, rather than your body, will absorb most of the radio waves and finally if you should place yourself into a hermetically sealed steel vault, no waves would pass through your body at all.

But what is the effect of these waves upon the human body? As far as we have been able to observe, directly and indirectly, the effect is practically nothing, or no more than the effect of sunlight on a pane of glass. There must be some effect, but it is very little—that is, with the power that is being employed by the radio stations at the present time; it is so weak that you must amplify it thousands of times in a receiving set in order to hear a single note. The human body itself as far as the radio wave is concerned is a conductor that conducts electric currents fairly well. If you live right underneath a powerful radio station there would undoubtedly be some effect on your body and this effect would be a beneficial one. It would possibly be of benefit to the human being, that is, if he is under the influence of the radio waves for twenty or thirty years. Under such influence then you would probably not be subjected to *arteriosclerosis* (hardening of the arteries). This is the most common pathological condition of man as he grows old.

I BELIEVE

¶ THAT near-facts are the greatest bane of humanity.

It was discovered by d'Arsonval some years ago that high frequency currents actually had the effect of greatly reducing this ailment (by lowering the blood pressure). Of course there would only be this beneficial action if one were living very close to the transmitting station. One mile away from it there would be practically no effect.

About fifty or one hundred years from now with super-radio stations generating millions or billions of kilowatts, the situation will probably change. The beneficial action will then be felt by everyone no matter where located on this globe. Furthermore, the high frequency currents will have become sufficiently powerful to have a vitalizing effect on every human being. We will all be electrified then—in the full meaning of the term. Not only man, but plant life will also be greatly stimulated as recent high frequency experiments on plants have shown. Our crops and plants will grow probably two to ten times as quickly and the crops will be more productive under this electrification. The super radio power stations will then also locally control the weather. If rain is required in a rural section, its radio power station will shut down for one or two days during the week, to allow rain to fall.

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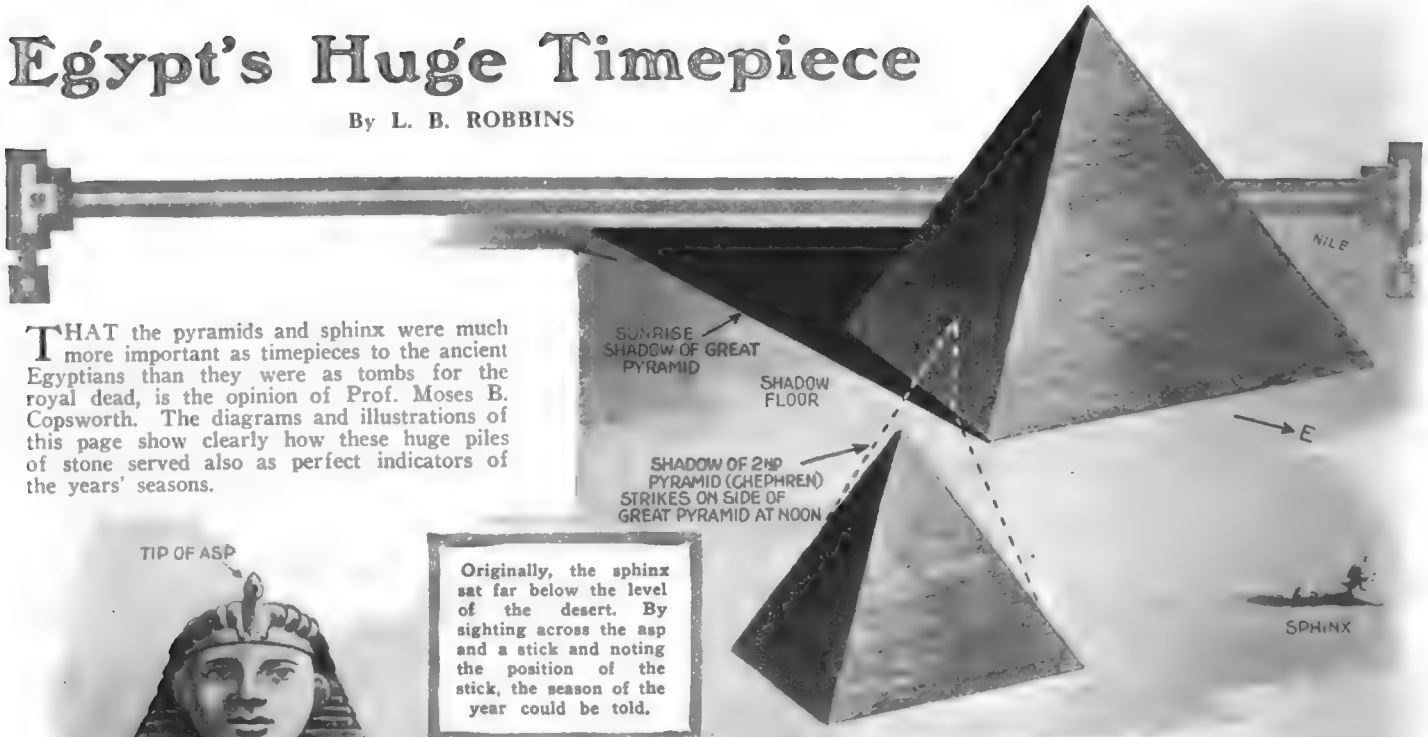
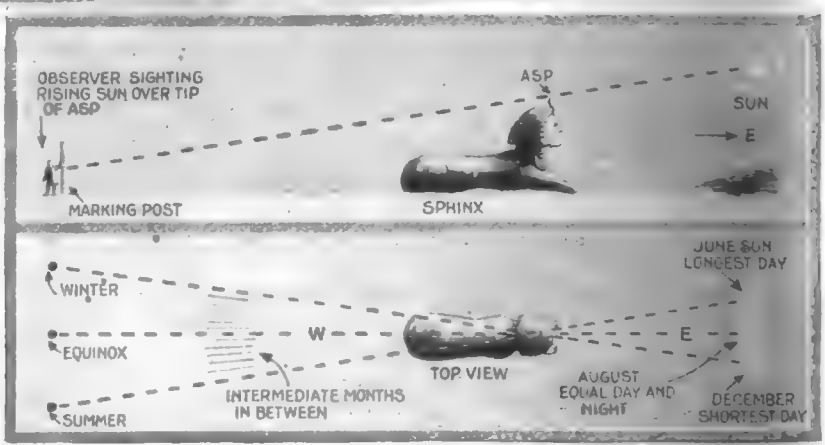
Egypt's Huge Timepiece

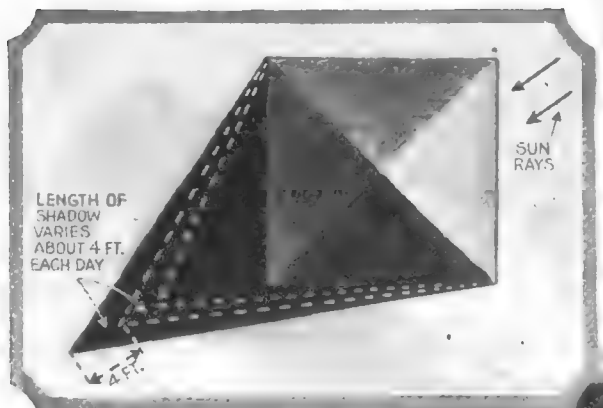
By L. B. ROBBINS

THAT the pyramids and sphinx were much more important as timepieces to the ancient Egyptians than they were as tombs for the royal dead, is the opinion of Prof. Moses B. Copsworth. The diagrams and illustrations of this page show clearly how these huge piles of stone served also as perfect indicators of the years' seasons.

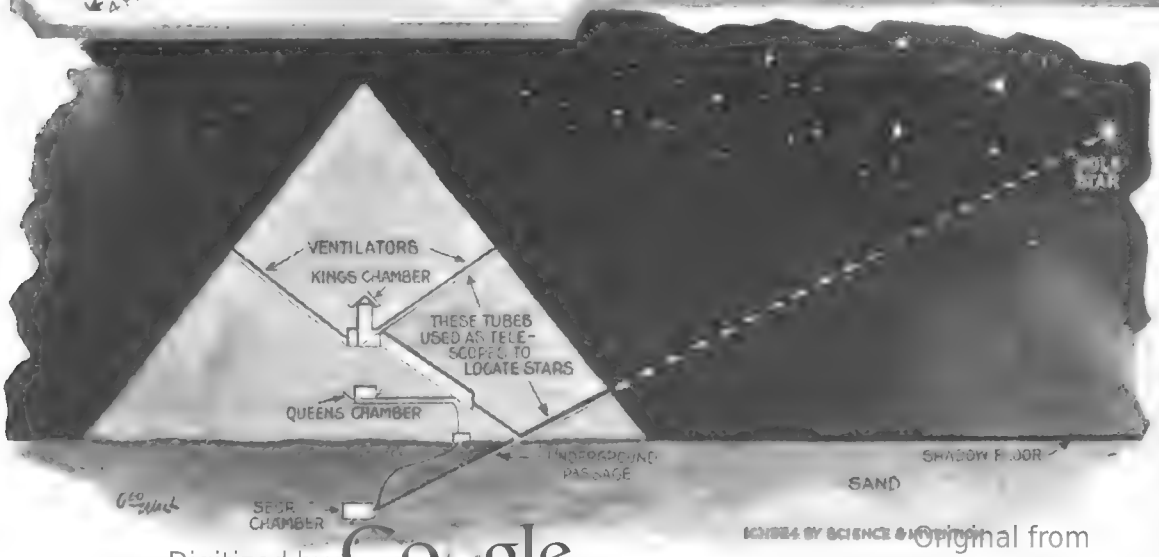


Originally, the sphinx sat far below the level of the desert. By sighting across the asp and a stick and noting the position of the stick, the season of the year could be told.





At the left is shown the method used in telling the exact day of the year with the aid of the great pyramid. With a difference of four feet a day in shadow length, it was very easy of course at noon to tell the exact position of the sun which indicated the position of the earth in its orbit and so to tell the exact period of the year. This theory is strongly upheld by the fact that there is a great shadow floor or perfectly flat surface extending behind this pyramid for some distance. The use of the pyramid and the sphinx as time-pieces was extremely important to Egyptians because they had no other system which the tillers of the soil could use for noting the time of planting and harvesting. The sphinx was used to denote seasons by the system shown directly above, according to Prof. Copsworth. This system was not nearly as accurate as that with the great pyramid.



After examination of the various passage ways in and below the great pyramid, the professor came to the conclusion also that at least one of them was used as a sort of telescope, or rather star finder, which the high priests used for telling meridian time. Note that the long passage way in the illustration at the left gives directly to the north star. This system of taking the time when a given star passes the longitude still obtains in all large observatories. This one case seems to be a particularly strong proof of the professor's theory.

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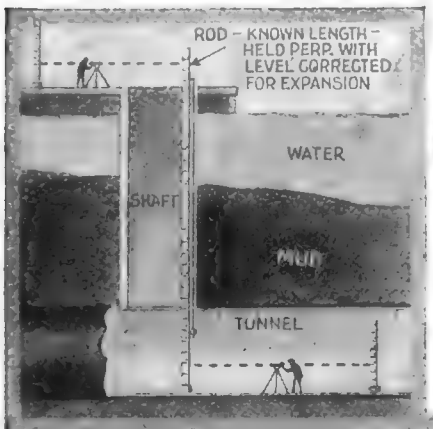
Hudson River Tunnels Meet

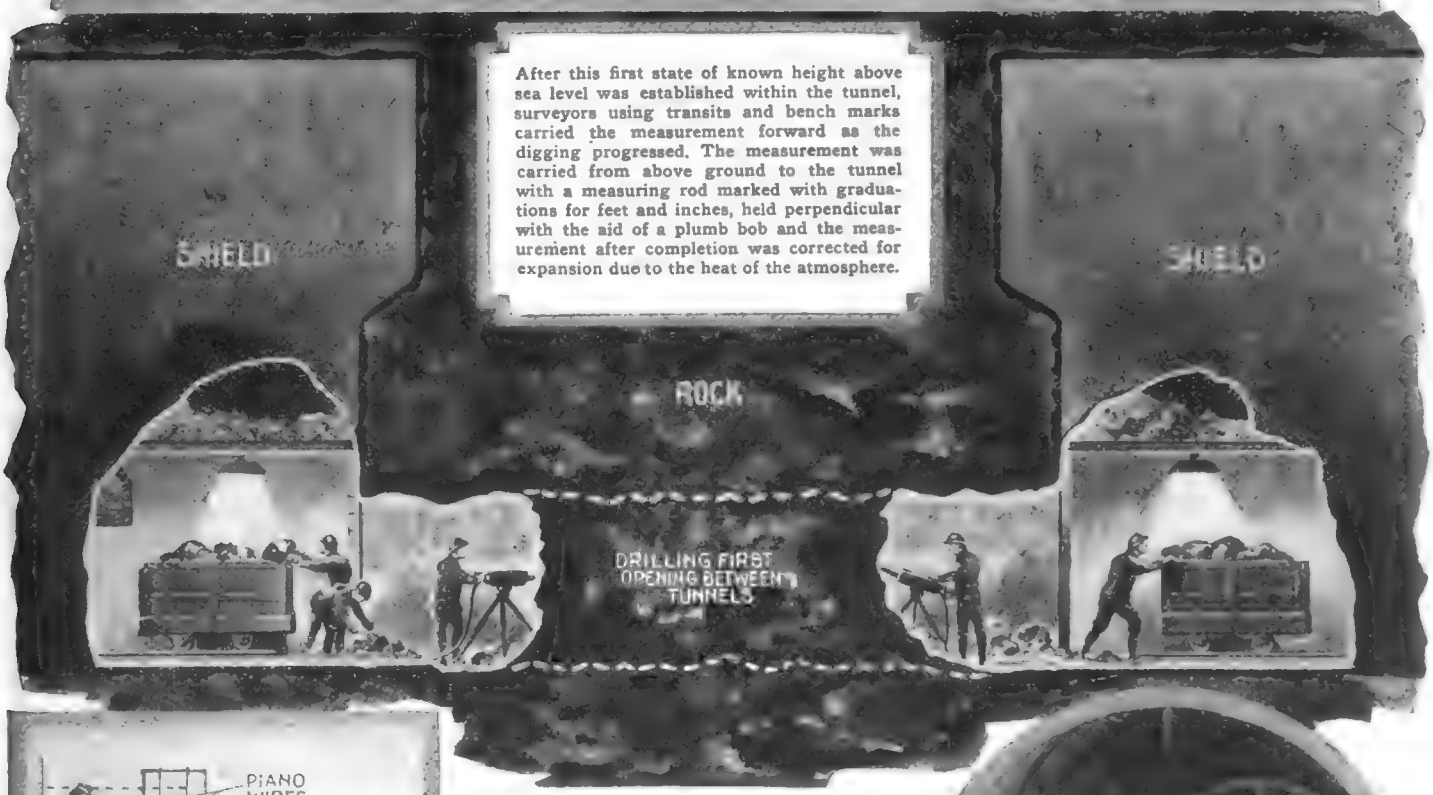
Giant Surveying Job Comes to Successful Conclusion

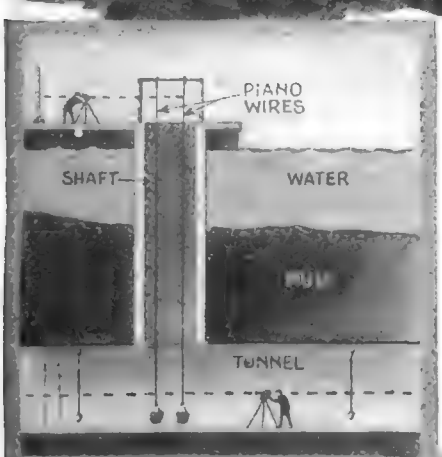
By W. B. ARVIN

THE two sections of the Hudson River Vehicular Tunnel, one being dug from New Jersey and the other from the New York side, meet in perfect union under the river, with a variation of only a few inches. This is indeed a feat of surveying since the base lines for both sides had to be taken from a longitude bearing, also the level or the vertical elevation of both shafts had to be maintained with the same accuracy as their lateral direction, else they would not meet. The sketch below shows the method used in running the level marks. A bench mark, or point of known height above mean sea level was set on both the New York and Jersey side. This mark was transferred to the tunnel as shown at the left.

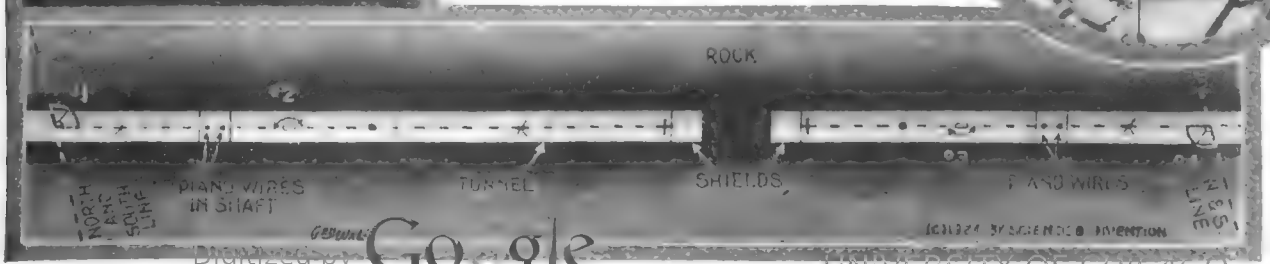


After this first state of known height above sea level was established within the tunnel, surveyors using transits and bench marks carried the measurement forward as the digging progressed. The measurement was carried from above ground to the tunnel with a measuring rod marked with graduations for feet and inches, held perpendicular with the aid of a plumb bob and the measurement after completion was corrected for expansion due to the heat of the atmosphere.





Above is shown the way the tunnels meet. The forward line for one-half the tunnel was obtained by first taking a longitude observation, obtaining an absolute north and south line on both shores. Then two piano wires with weights attached were hung in this line down a shaft communicating with the tunnel proper. The surveyor below then set his transit in line with these two wires, so the same line, in effect, is used on both sides of the tunnel. At the right is shown the method used by surveyors in controlling the position of the head of the shield. Sighting from the plumb bob which denotes the line, the surveyor determines the direction of the shield, and with the level rod, its vertical location.



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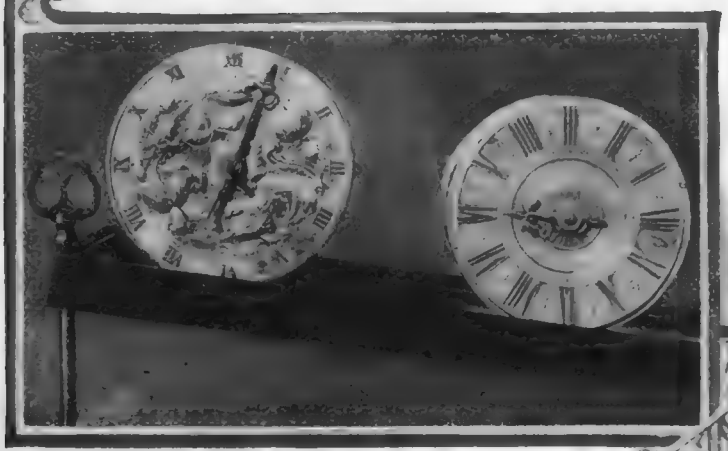
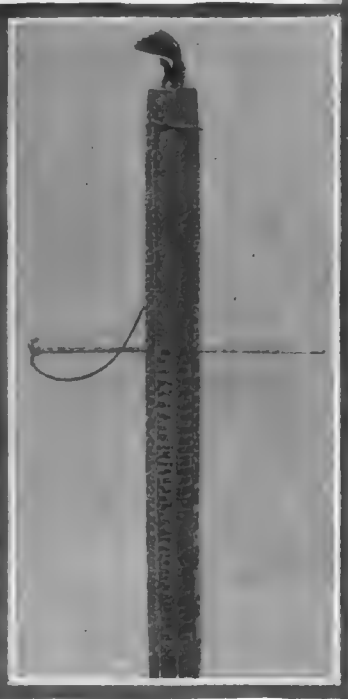
Unique Clocks

MARSHALL KELLY



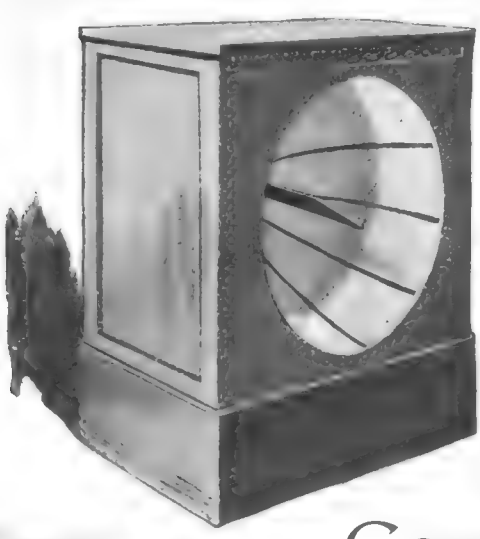
Louis XIV had a very novel clock which operated by rolling down an incline plane. Such a clock is shown in the above illustration. When the clock ran down, it was only necessary to set it at the top of the plane again.

Maria Theresa had one of the most novel clocks the French court ever saw. It consisted of a sun dial with a small cannon which was fired on the hour. It was placed just under that famous lady's window.

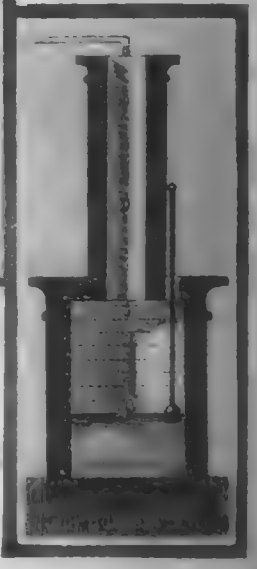


Above we have one of the early portable sun dials. It was adjusted for latitude. The gnomon which casts the shadow was collapsible.

A Gothic weight clock which marked the time by the descent of the weight down the scale, is shown above.



THE oil lamp of Mary Stewart marked time by the change in the position of the oil in the cylinder. A gauge was fixed alongside the cylinder so the time could be read directly. To the right of this novel timepiece is shown the Indian Pilgrim staff which told the time by the sun dial method. A peg was passed though the stick, and the location of the shadow marked the time. Directly above is shown a Japanese sand glass arrangement fixed so that one glass was continually marking the passage of the hours. The appliance which kept the time constantly was an improvement over the original hour glass idea, which necessitated turning every hour exactly as the last of the sand passed through the aperture in the glass. At the left is shown the bowl moon dial. The gnomon was of course arranged so that adjustment could be made for differences in latitude. It worked on exactly the same principle as the sun dial with the exception that the moon cast the shadow. At the right is shown possibly the oldest clock. Time was kept by the water dripping into the bath raising the indicator.



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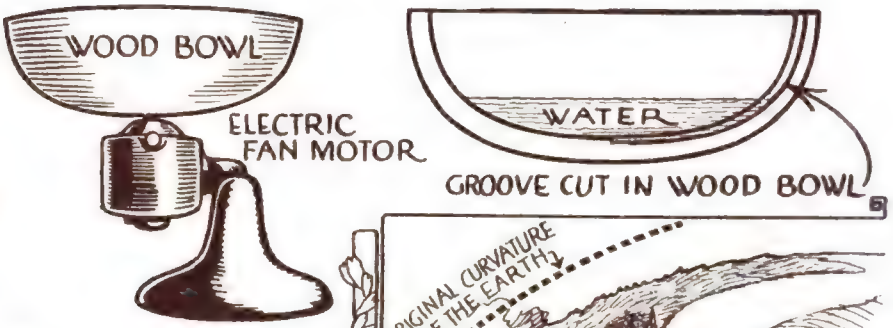
If the Earth Changed Speed

By CLEVE HALLENBECK

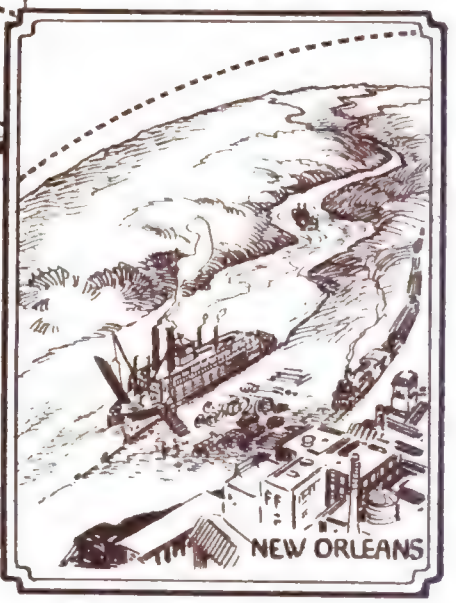
The dotted lines surrounding the sphere show, exaggerated of course, the flattening of the earth at the poles. This accounts, under the laws of gravitation, for making all lands from the equator to the North and South Poles have a trend "Down Hill."

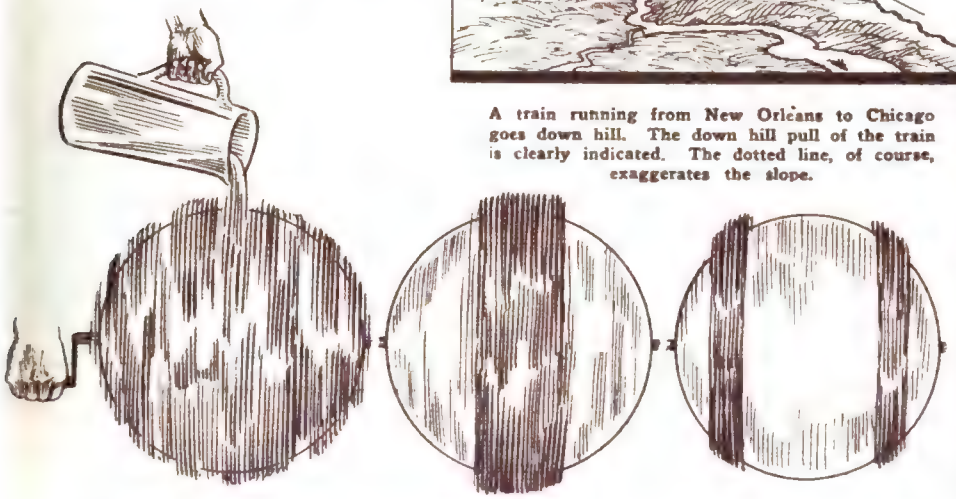


The experiment above showing the revolving grooved bowl, demonstrates how centrifugal force causes the Mississippi to flow up hill. The waters at the bottom of the bowl will rise up the sides as the bowl revolves and at a certain speed the water will flow up the groove and out of the bowl.

The original curvature of the earth is illustrated by the dotted line above. Chicago is actually 8,590 feet lower than New Orleans, that is, it is 8,590 feet below the circumference of a circle having its center at the center of the earth and passing through New Orleans.

A train running from New Orleans to Chicago goes down hill. The down hill pull of the train is clearly indicated. The dotted line, of course, exaggerates the slope.





Centrifugal force is illustrated above. If a thick viscous fluid is poured on the revolving sphere, at a certain speed it will cover evenly the face of the sphere. At a faster speed it will gather at the equator and at a slower speed will flow towards the two polar regions.

If the earth were to slow up its speed gradually, the waters of the oceans would pile up at the poles, leaving a belt of dry land on the shaded portion of the world map below.

THE mouth of the Mississippi River is two miles higher than its beginning, in other words the water of the river flows uphill more than two miles in reaching the ocean. This state of affairs results from the flattening of the earth at the Poles, which process occurred at the formation of our planet. The Mississippi is able to make this rise and flow uphill because of centrifugal force. If the earth slowed its revolutionary movement only very slightly, the Mississippi would cease to flow altogether. If the rotation were to increase, on the other hand, the river's speed would also increase and the ocean would pile up at the equator as well. The old high school physics law that "water always seeks its own level" is only true when there is no force aside from gravitation acting upon the water. Were it not for this force we should have almost a perfect sphere on which to live because the waters of the oceans would flow to the cold regions until the present flattening of the globe at the poles was counteracted.

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The LIVING DEATH

By JOHN MARTIN LEAHY

There was a mob around Frontenac's gates.

"'The true may sometimes not be probable.' But science takes accounting of the truth, not of the probability."—Victor Laporte.

CHAPTER I

THE DISCOVERY

WHAT I had read was surprising simply amazing. And yet why should I be surprised at my surprise and amazement? For *this* was not the first time. Yes, more than once, arriving at Darwin Frontenac's home, I had been surprised, and once or twice shocked with an accompanying shudder. For some of the studies and experiments of my friend—a strange friend, but one as true as strange—were as unearthly as ever entered the mind of man.

I thought of some of these things; but never the faintest thought came, as I sent my automobile spinning along the smooth road, that this was the most momentous day ever to be known in all my life.

However, as I drove along, I was not a little puzzled. For, after all, what was I to make of those amazing stories in the newspapers? The first word of his discovery had been given to print (under somewhat unusual circumstances, it seemed) only a few days before; yet already the world was buzzing with interest and comment, from Seattle to London and Paris and even on to Shanghai.

Some of that comment makes curious reading now; but how was the world to know? No wonder there were "Doubting Thomases." The thing was too bizarre, too gruesome.

Why, even I, who knew the man and his work as, I felt sure, no other man knew, doubted.

"Yes," I thought, "this must be another of those wild newspaper yarns! It can not be otherwise. When did a reporter ever get a scientific story straight? That there was some foundation for the story—or, rather, stories—I did not doubt for one moment.

I had been away five months, and (if it had been any one else) I could have sworn that he was not even interested in such a thing on my departure, let alone experimenting. And now this! Not the slightest mention of it had occurred in a single one of his letters.

The stories should be taken *cum grano salis.*

WITH this issue, we are beginning an important scientific fiction serial:

The LIVING DEATH

by John Martin Leahy

This is a gripping story of the South and the Antarctic. The prediction has often been made that somewhere in the Antarctic, a tropical plateau would be discovered which will be surrounded by ice on all sides. There is a good scientific reasoning for this and Mr. Leahy discusses it all, not only in masterful fiction, but with a masterful grasp of the scientific facts which he includes as well.

The footnotes found throughout the work are actual references to standard textbooks or lectures given by world famed authorities, or explorers.

This is a story that will grip you from start to finish. We warmly commend this serial to our readers.

—Editor.

If I had only known the truth—above all, what was to follow!

TO THE HOUSE

At length I left the main road, taking one that led off to the right. A few moments, and the summit of the gentle acclivity was reached, whence an extensive view meets the eye. There, stretching from south to north, glittered Puget Sound. A short distance before, the red roof of Frontenac's house came into view.

The road gave a sudden turn and I, a sudden exclamation. A few curious persons would have seemed no surprise, but what I saw certainly was. There must have been twenty cars parked along the fence, and all of two hundred people gathered at the house. Here and yon little crowds were clustered about some wiseacre, and, as I rolled forward, I heard "bunk" and "faker" and sundry phrases and epithets no more complimentary than these.

And, there inside, puttering about the flowers and shrubs, was Blubs, the gardener and general handy man about the place. It was obvious, however, that the work engaging his hands was not taking his whole attention. Blubs, in reality, was on guard.

From the look he fixed on the car, I thought he was expecting some one. There was a sudden look of recognition, and the next instant he was moving toward the gate.

"Well, well," he said, as he swung the gate open, "if it isn't Mr. McQuestion back!"

"Not expecting me, eh, Blubs?"

"No," he answered. "I thought at first that it was—you see, I thought it was somebody else."

WELCOMED

My ring was answered by Frontenac himself. A look of surprise crossed his lean features and lighted up the somber gray of his eyes.

"Bond!" he exclaimed, and thrust out his hands and grasped me by the shoulders. "So it's you! When did you arrive?"

"You didn't know I'd returned?"

"Not until I opened the door and saw you here."

"I tried to get you on the phone. Sherrill answered, said you were expected back any moment, and he said that——"

"Oh, I see! And, when I did get back, Sherrill suddenly found so many matters on hand he forget to tell me about it."

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"Come in, Bond, come in!" he exclaimed with a sudden alteration of tone and manner. "You mustn't be surprised if things are a little upset about the place, though it would be rather difficult to say precisely why they should be so. Certainly I can't tell you. All this hullabaloo!"

He waved me into a chair and took another himself, crossing his legs and elbows resting on the arms of the chair, placed his chin on his long clasped fingers.

"Well, well, I'm certainly glad to see you again. Alaska seems to agree with you."

"And," I returned, "it seems you have been making a little Alaska of your own down here."

A smile touched his face.

"So you have been reading the papers?"

I nodded.

"And tell me this, have the papers got this business straight?"

"Not straight, of course, Bond; they never do get scientific things straight. Why, your reporter is a wonder if he knows that Polaris isn't Archaeopteryx!"

"What I mean," I told him, "is this: have you really done what these accounts say?"

"I have," said Frontenac, "and a few things beside which they know nothing about."

"You mean to tell me—Great Heaven, you mean to say that you can——?"

"Certainly I can! It was not my intention to have it made public so soon, however. This has—well, disarranged things a little. I'll have more sense next time. It was that old fuddlecap Professor Archimedes Bukink that gave the story away—the old rattlebrained bagpipe. Oh, well, it's all my own fault. I ought to have had more sense than to let him know of it."

AN ARRIVAL

"But look here——" I began.

"There," interrupted Frontenac, "there he is at last."

He was looking out the window, towards the gate, which Blubs had just opened and through which an automobile was moving.

"Who?"

The look he gave made me wonder.

"Stanley Livingstone," he said.

"Stanley Livingstone!"

"Yes, Captain Stanley Livingstone. There in the back seat."

"That faker!" I exclaimed.

Frontenac held up a finger.

"Easy, Bond. Not so precipitate. Remember, even Newton and Columbus were fakers once."

Shades of the great Münchausen!" I exclaimed. "Do you really believe in that man?"

"This is not the moment to say what I believe or do not believe. I have been waiting this visit with more interest than you can easily imagine. It has me guessing in more ways than one. Why is he coming—he of all men? What is this strange tale he has to tell me, and why has my discovery brought that man here?"

While we watched the fish broke loose from the ice and began to swim.

"You'll soon have the answer to that," I smiled. "But what is the Captain doing in Seattle?"

"Outfitting for another expedition."

"To the *North* Pole, this time?"

"No. To the Antarctic Continent again. I understand, however, that his health has caused some hitch in the plans."

"Well," I observed, "here he comes! I want to meet the man, but don't worry; I'll soon excuse myself and leave you two to your mysterious confab."

"By no means, Bond!"

He placed a hand on my arm, and the seriousness of his manner astonished me.

"I want you to remain—well, as a witness, say. Something tells me the story will prove no common one."

And the next moment he was moving toward the door to receive the arrival.

CHAPTER II

CAPTAIN STANLEY LIVINGSTONE

THE meeting with Captain Stanley Livingstone left my thoughts in confusion. This man I had set down as an unmitigated faker. Yet, as I saw his rugged, weather-beaten face, his clear blue eyes, doubts as to the correctness of my opinion arose. The impression produced upon me by the captain's personal appearance was very much in his favor.

This was not the face of a faker. And yet it was not pleasant to look upon. There was an unsightly puffiness about the features and a livid hue which stood out even through the tan. Captain Livingstone was a sick man. His troubled breathing, and the alacrity with which he sank into the chair pushed forward by Frontenac attested to his illness.

The captain lost little time in the small talk customary on such occasions.

"I have come to you, Mr. Frontenac," he said suddenly, "to tell you the strangest story one man ever told another. And, as I am a living and honorable man (though dishonorable, or worse, in the eyes of the world) every syllable of it is true."

He paused, and for an instant his eyes rested on me with a look the meaning of which could not be mistaken.

THE CAPTAIN SPEAKS

"I assure you, Captain Livingstone," Frontenac said in reply to the look, "that I am very sensible of the honor thus accorded me. Also, I assure you that you may thoroughly rely on the discretion of my friend McQuestion here. Should there be anything in your story you wish held secret, you need have no fear of either of us betraying the trust."

The captain gave something like a bow.

"I believe it," he said after a momentary pause, "and so I will tell you my story; tell you of the strangest, the most astounding scientific discovery ever made. The world sneered and jibed at what I did tell. So why should I have taken the trouble to bring out proof—even if I had not the horrible stares of the curious and the vile publicity she would have been subjected to."

Darwin Frontenac leaned forward.

"She?" he queried.

And I caught at the eagerness in his voice.

"Yes," said Captain Livingstone. "In a —a museum!"

He gave a fierce gesture.

"Yes, that is what they would have done to her, that or something even worse—after all these thousands of years. I have been in something akin to despair ever since that awful day I found her. But now, Mr. Frontenac, your discovery changes everything. You are the one man in the world who can save her. And even you—no, I will not think that."

"Save *her?*" queried Darwin Frontenac.

"Yes, sir: *save* her."

"From what?"

"From eternal sleep—or one of the foulest of deaths."

"All this, Captain Livingstone, is something of a riddle to me."

"Yes, yes; but I will make all plain."

He was silent for a moment, then added:

"As for me, gentlemen, I am finished—I am a doomed man."

His head sank forward, but the weakness was ephemeral: the next moment he raised his head and fixed his look once more on Frontenac.

"Aneurism of the aorta," he grunted.

That explained the puffiness and livid hue of his skin. Such a man, I knew, was not certain of his life from one minute to the next.

The explorer went on, "My days on this earth are numbered. Well, so be it.

(Continued on Page 602)

"It is the strangest story man ever heard," the captain was saying. "I come to you with it because you are the only one who can save her from everlasting sleep."

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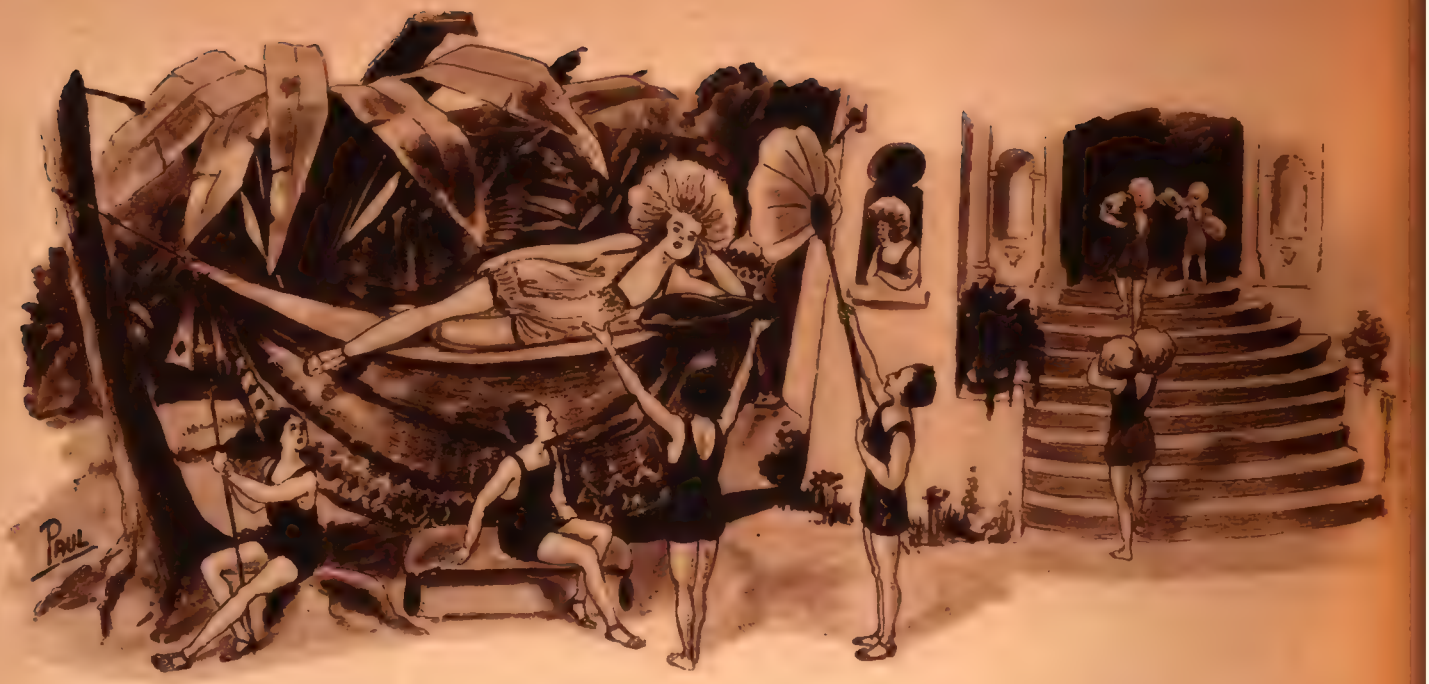

"And now there appeared on the screen a wonderful picture of a beautiful woman reclining in a sort of hammock; bare-legged and bare-armed like the others, but considerably larger than her sisters. The far-famed Helen of Troy or even Venus in all their glory would have been put to utter shame."

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 33. The Secret of the Microscopic World

AUTHOR'S Note. This somewhat fantastic story of a microscopic world of men and women, is written for the purpose of giving in palatable form, some interesting and not commonly known facts in regard to bees, especially in regard to the manner in which the bees contrive to hatch out males or females at will. My facts are taken from some of the best authorities, and hence may be relied upon. As to my speculations concerning the formation of a class of human neuters in the not distant future—this is less a matter of theory than a matter of fact. Even at the present day families are very small and are continually growing smaller, while the number of bachelors and maids is increasing yearly, forming what is really a class of neuters in the human race.)

YOU'VE come just in time, Silas," said Doctor Hackensaw. "I've got something to show you, to-day, that is, in its way, more wonderful than anything you have yet seen—I myself would not believe it if I hadn't seen it with my own eyes. Truly Shakespeare was right when he said: 'There are more things in Heaven and Earth, Horatio, than are dreamt of in thy philosophy!'"

"Don't keep me on pins and needles, doctor. Tell me at once what this new wonder is that you're going to show me," said the reporter with a smile.

"Silas," continued the doctor impressively, "It's a common failing of mankind to believe that all the greatest discoveries have already been made. In the last hundred years we have seen all the marvels accomplished by steam, electricity, and radio-activity, yet still we doubt that the future has similar great surprises in store for us. Of course we are ready to admit if some of the planets, like Mars and Venus, may have new wonders to show us, but as to the earth itself we think we know it pretty well. As a matter of fact, we know very little about it—especially the microscopic world. Well, Silas, I once showed you my super-microscope. Evidently discoveries of the greatest importance await us in the world of the infinitely small, and I spared neither time nor money in perfecting my instrument. I have made many discoveries in regard to the constitution of matter, the life histories of disease germs and other bacteria, and have solved a number of the problems relating to life itself. But recently I had the good fortune of stumbling upon a microscopic world such as I had never dreamt of. Silas, if I were to tell you that I have found on a speck of earth no larger than the size of a pin-point, a world of microscopic men and women with their cities and farms, their commerce and industries, you would laugh at me and think I had lost my reason. But the fact remains that I have found just such a world. How I ever came to hit on it is a mystery, for there seems only one such world—I have searched the surrounding particles in vain for anything like it, though even if another existed, the chances are great that I could never find it—The search would be far more difficult than the traditional one of looking for a needle in a haystack. But this microscopic world seems unique."

"Pegasus would have been treated royally had he had such a noble master. But horror of horrors! Another flesh eating dinosaur asleep in the forests was awakened by the tramp of the unicorn's hoofs, and with one pounce had knocked over the horse and seized the fair rider in his reptilian jaws!"

Silas Rockett's incredulity showed on his face, but he was too polite to say what he thought.

"I see you don't believe me, Silas, and I don't blame you. I, myself, couldn't believe my own eyes when I found this microcosm,—excuse me, I mean this small world—in the field of my microscope. The thing, however, is not so impossible as it seems at first sight. You understand the laws of 'evolution' or 'the survival of the fittest,' as Herbert Spencer called it. As a rule, the large animal has an advantage over the small ones, and hence evolution is usually from the one-celled animal or plant to the larger mammals. But size is not always an advantage. The large animal requires more food, and is more readily found by his enemies. Natural selection has produced the microbe as well as the elephant and the whale. In fact, above a certain limit, size seems a decided disadvantage; for all the large ante-diluvian monsters have perished from the face of the earth. Such giants as the brontosaurus, the eighty-foot long diplodocus, and the hundred-foot long gigantosaurus have all vanished. They were so large, and could not compete with the small species—they succumbed in the battle of

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because their enemies found them an easy prey.

"Now size is a very variable quality in animals, as we see in the dog and the horse. The former ranges in size from the toy dog you can hold in your hand, to the gigantic mastiffs. The horse varies from the small Shetland pony to the immense Percheron, and, in ancient times, horses existed that were no larger than small dogs. Similarly with plants. The scrub oak and the scrub pine are low forms closely related to the giant oaks and pines of our forests."

"That's true," assented Silas.

"Size is a mere matter of relativity," Einsteined the doctor. Nature can produce a minute insect as easily as an antediluvian monster. And as the small animal can more rapidly escape extinction, it is the most natural thing in the world that a race of men and women should have gradually become smaller and smaller until finally they attained microscopic size. In Africa there are tribes of dwarfs less than three feet high. Among the monkeys there are some very small species. Under certain conditions we can easily conceive how the microscopic world evolved. However, be the reason what it may, such a race of diminutive men and women exists, and I'm going to show it to you right now. You will be the first person besides myself who has seen it. Come with me to my 'microscope rooms'."

"Microscope rooms?" echoed Silas—"Have you more than one microscope?"

"Yes indeed. My super-microscope is in fact nothing but a combination of several microscopes, each one enlarging the image it receives and passing it on to the next. Here is Microscope No. 1," continued the doctor, opening the door that led to a peculiarly constructed room containing an immense instrument. The lenses were several feet in diameter and the instrument itself was some twenty feet high. All the adjustments had to be made by machinery. There appeared to be nothing on the object glass, but in reality there was an almost invisible speck of earth, illuminated by most powerful electric lights, whose beams, however, first passed through suitable solutions that filtered out the heat-rays that would otherwise have destroyed the microscopic world in an instant."

"That's a fine instrument," said Silas, "but it must have cost a pretty penny."

"It did, but it's worth every cent of it. And this is only one of the microscopes. Come now into the second room."

The second room contained Microscope No. 2.

"You see," explained Doctor Hackensaw, "the great problem in obtaining successive enlargements is to find some means of illuminating each enlargement you obtain.—Otherwise the light soon becomes insufficient. To achieve this result, the images in my first microscope are photographed by a moving-picture camera which takes about a hundred snap-shots per second (developing the plate at the same time.) I study this film carefully and a special device enables me to pass the film through the second microscope in such a way that the particular spot I have chosen will be the one to be magnified as the film passes through. Of course, as you understand, there is not the slightest difficulty in illuminating the film or negative as highly as I wish. And the records being permanent I can go back at will and magnify other portions of the original film—As a rule, however, I magnify the central portion of the picture, as there is of course less distortion of the image by so doing—Each succeeding microscope merely repeats the process. It takes some one central spot on each of the image of the previous films, and enlarges this again—Finally, for convenience, the last negatives, which like the others are taken in natural colors by a process of my own, are projected on an ordinary movie-screen and give me a slow-up of the scene actually occurring in the microscopic world. By means of audions and a loud speaker, I can at the same time hear the sounds made by the creatures, as you will perceive for yourself."

So saying, Doctor Hackensaw pressed a button, and the room was in total darkness. Instead of a sheet, the screen was a mirror, and as the projector began to automatically throw the images on the screen Silas beheld a vision that filled him with delight. It was a real city which was depicted here, with houses of magnificent architecture, but altogether different from our modern ugly buildings—They were more in the Oriental style of the Hindoos—The costumes, too, were different from ours, simple but very attractive, both men and women having bare arms and legs. They were very much like humans too, but more refined in features. And the figures spoke to each other, though Silas was unable to understand a word that they said.

"Why, they have a language of their own!" he cried.

"Yes," answered Doctor Hackensaw, triumphantly. "They speak the language from which our Sanskrit must have originally evolved, for it possesses many Sanskrit roots. Believe me, it was some job to understand their speech, but by catching the conversations on phonographic records and giving them to some of our best Sanskirt scholars to decipher, I have been enabled to understand what they say. And the fact that these men speak a Sanskirt language bears out my theory that these people are descended from normal-sized men and women."

"Then they are really men and women like us?" queried the reporter.

"Not exactly. Wait until you have seen the queen." And Doctor Hackensaw adjusted a few thumb-screws, bringing a different roll of film on the machine. And now there appeared on the screen a wonderful picture of a beautiful woman reclining in a sort of hammock; bare-legged and bare-armed like the others, but considerably larger than her sisters.

"Isn't she a beauty!" cried Doctor Hackensaw, enthusiastically—I call her Ionia because an ion is the smallest thing known—She is a dear girl, and I confess I have fallen in love with her."

"But how is it that she is so much larger than the others?"

"I will tell you my explanation, Silas, and I think it is the true one. I believe Ionia is a queen in the same sense as the queen bee in a hive;—in a word that she is the mother of all her subjects."

"Good gracious!"

"To the large majority of people, Silas, the relation between the sexes is looked upon as something half way between a sin and a

(*Continued on page* 620)

"There amid a luxuriant tropical vegetation of palm-like cycads, tree-ferns, and tropical cone-bearing trees, was an enormous brontosaurus quietly grazing. Much sooner would I have dared to face the terrors of Scylla and Charybdis than meet this carnivorous reptilian monster."

"—and as the projector began to automatically throw the images on the screen, Silas beheld a vision that filled him with delight. It was a real city which was depicted here, with houses of magnificent architecture but altogether different from our modern ugly buildings. They were more in the Oriental style of the Hindoos—."

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Scientific Innovations

Humorous and Peculiar Scientific Stunts

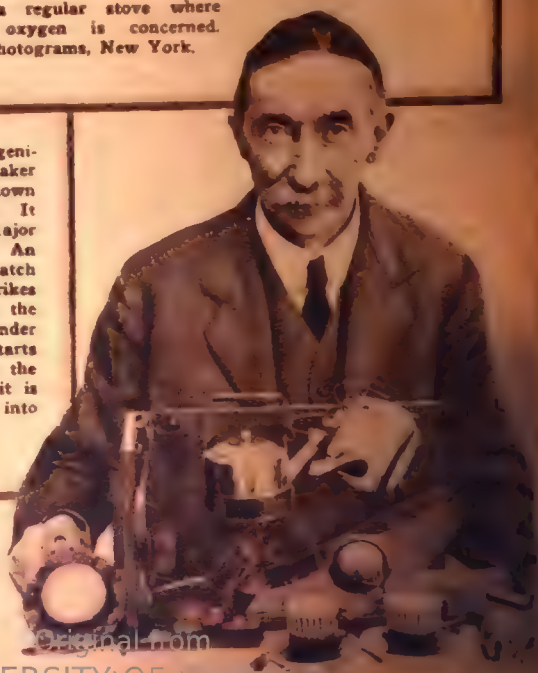
ANOTHER brave Helicopter experimenter met the end in Paris, which has befallen so many in recent years M. Doncharet, French air expert, and inventor of the helicopter, was acting as pilot. The machine rose only a few feet from the ground, when a sudden gust of wind capsized it. Neither the pilot or the machine were seriously injured. The aviator said that he would continue his work along the line looking for a solution of the problem. In the present instance a huge propeller acted as the lifting force.

We have wooden shoes, from Holland, grass shoes from China, carpet slippers from Turkey, and now the latest, none other than rubber shoes made from automobile tires. In the illustration at the right we see a gentleman using this latest method of beating the shoe profiteer at his own business. His shoes are made from segments of old tires.

Cooking on ice will at once appeal to the housewife as the very best method of preparing meals during the hot summer months. The kettle in the above photograph boils and boils, all the time setting on a cake of ice. The secret, however, is that the kettle contains not water but liquified oxygen at more than 360 degrees below zero. The cake of ice is truly a regular stove where liquid oxygen is concerned.

© Photograms, New York.

Probably the most ingenious and efficient tea-maker ever brought out is shown in the left illustration. It is the invention of Major Dopping Hepenstal. An alarm clock lifts a match from a container, strikes the match, holds it to the wick of a spirit lamp under the tea kettle and so starts things moving. When the tea comes to a boil, it is automatically poured into the pot.



Since the diplomats discovered a few months ago, that oil would probably win the next war, the Bureau of Standards, has taken extreme interest in it. Above is shown their latest device for prospecting. By testing the gases, found in spring waters, the Bureau can ascertain whether oil or gas is in evidence and how far it is distant from the source of water.

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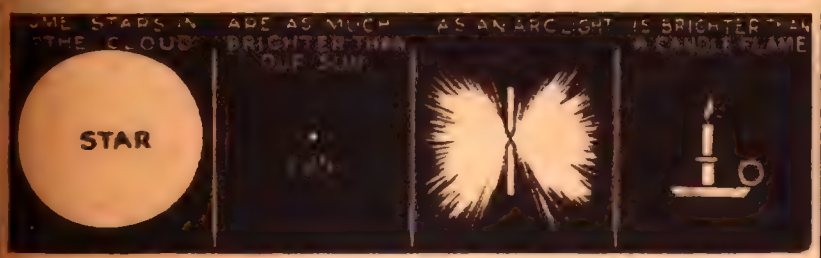
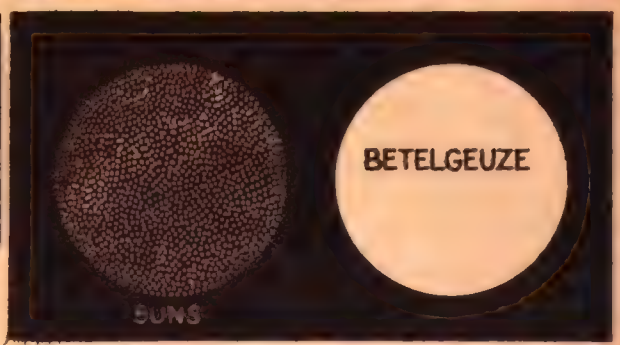
Our Sun Is a Pygmy

By CHARLES S. HOWARD, Ph.D.

The Small Magellanic Cloud is a group of stars and nebulae. It is not visible from the Northern Hemisphere and received its name from Magellan, the well-known explorer, who saw it on his visit to the southern part of the world. Astronomers at Harvard Observatory have measured its distance. It is 600,000,000,000,000,000 miles away, its light, traveling 186,000 miles a second, takes about 100,000 years to reach us.



To gain some idea of the huge size of the object it might be said that light takes about 30,000 years to pass from one end to the other. If a star as bright as our own sun were in the Magellanic Cloud the largest telescope on earth would be unable to see it. All of the stars visible are hundreds and some of them thousands of times brighter than the sun. The very brightest stars ever found are some of these in the Cloud. They radiate about 50,000 times as much light as our sun. When Mt. Wilson measured the diameter of the star Betelgeuse a few years ago we thought we had reached the limit of largeness when it was found that it would about fit inside of the orbit of Mars. The largest Magellanic Cloud stars have diameters of the order of magnitude of the orbit of



Jupiter, about 900 million miles. It would take 30,000,000 suns to fill the volume occupied by the star Betelgeuse, but it would take thirty stars the size of Betelgeuse to equal one of these huge Magellanic Cloud stars.

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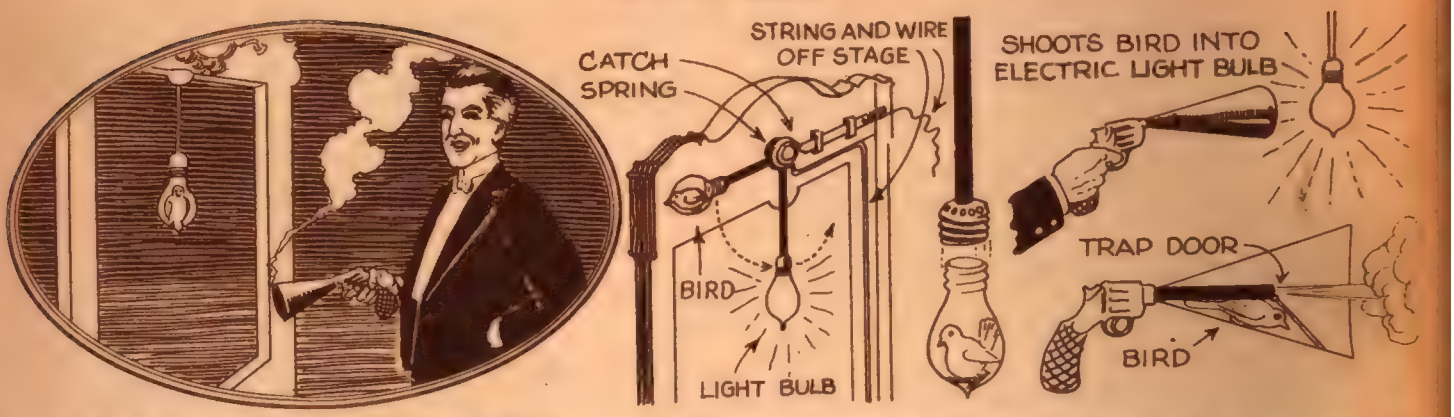
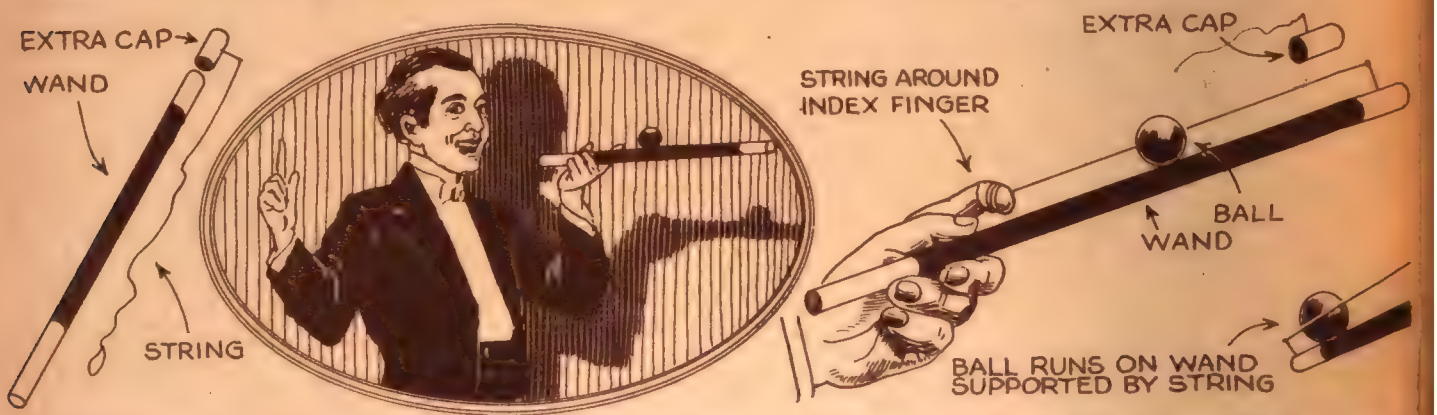
Magic for Everybody

By Prof. JOSEPH DUNNINGER

NO. 19 OF A SERIES

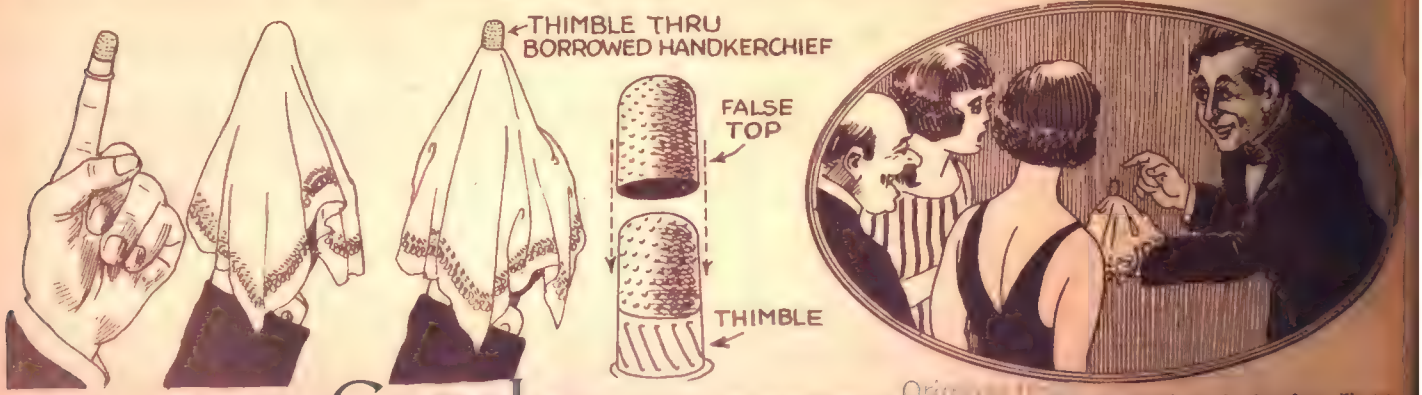


The magician places the bird in a prepared compartment in the pistol, fires at the bulb and behold, the bird is in the bulb. An assistant behind scene pulls a string which drops the bird into view with the device shown. The magician breaks the glass and the bird flies away.



The conjurer becomes a juggler, the billiard ball rolls up and down his wand. An extra cap with a string attached and a billiard ball balanced between the string and wand make the stunt easy. The false tip of the wand is removed before passing it out for examination.

A magician forces a handkerchief into the barrel of a gun, and fires with the barrel pointing toward the bottle resting on a table and lo, the handkerchief is found in the corked bottle. The trick is explicable seeing the hollow cork holding a second handkerchief. The string passes to an assistant.



To pass a thimble through a handkerchief without making a hole in it is the magician's next stunt. However, it is quite simply performed if the thimble is equipped with a duplicate top, such as the one shown in the above illustration. Dexterity is all the magician needs for performance.

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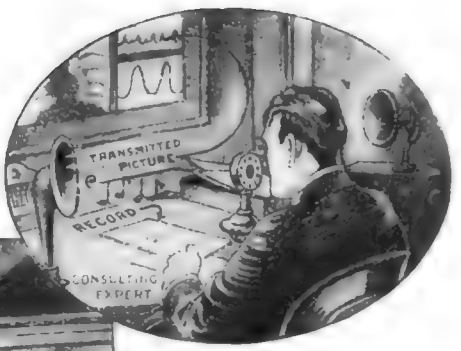
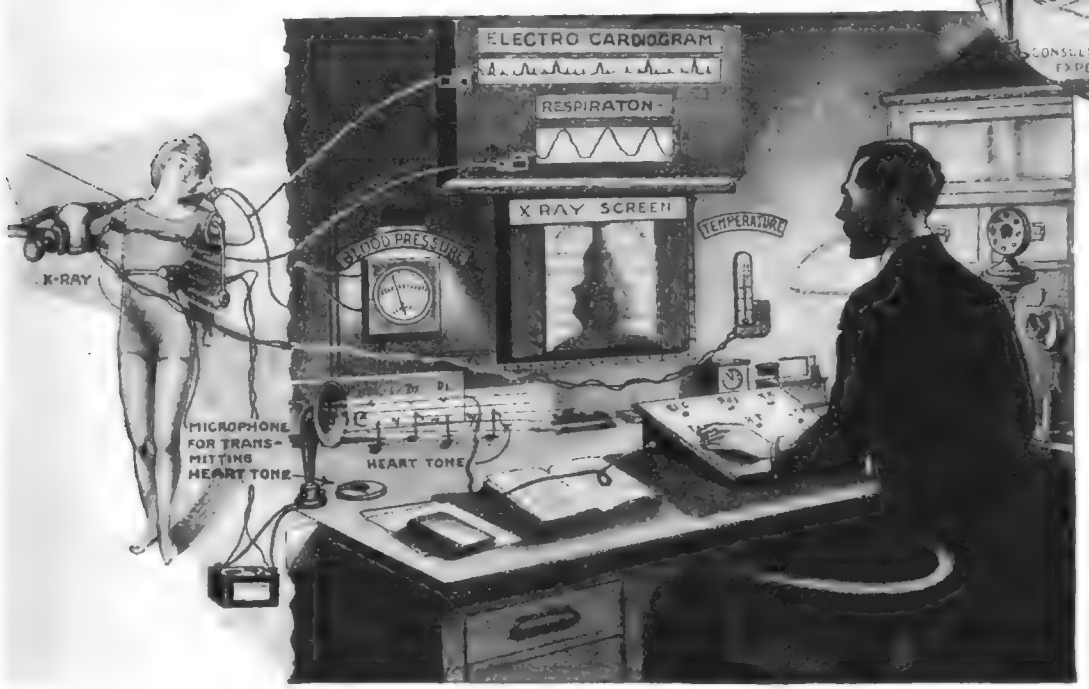
Specialist Brought To Every Town

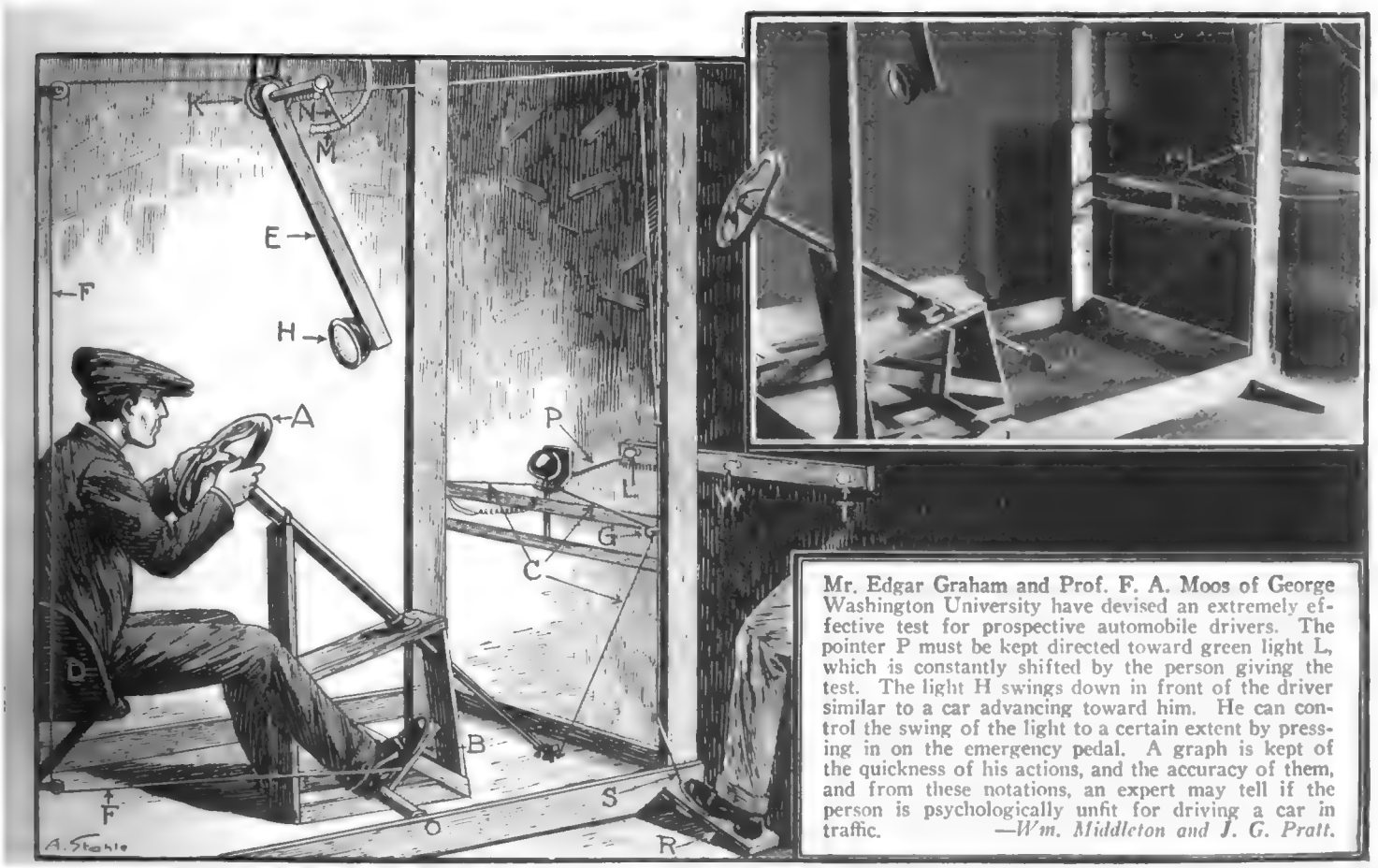
Electric Transmitting Devices Carry Symptoms





WITH the aid of electrical indicating devices, it is easily possible to transmit the findings of any disease over wires from one place to another with almost absolute accuracy. The ideas necessary are shown in the illustration herewith. A cardiograph is attached to the patient's two wrists and the variations in the current can be made to register in the distant specialist's office. Respiration pressure is transmitted through a carbon rheostat, the same as is the case with the blood pressure. The heart tone is transmitted by a radio microphone, temperature through a thermocouple. An X-ray of the infected member is transmitted by television.

Ingenious Driver's Test



Mr. Edgar Graham and Prof. F. A. Moos of George Washington University have devised an extremely effective test for prospective automobile drivers. The pointer P must be kept directed toward green light L, which is constantly shifted by the person giving the test. The light H swings down in front of the driver similar to a car advancing toward him. He can control the swing of the light to a certain extent by pressing in on the emergency pedal. A graph is kept of the quickness of his actions, and the accuracy of them, and from these notations, an expert may tell if the person is psychologically unfit for driving a car in traffic. —*Wm. Middleton and J. G. Pratt.*

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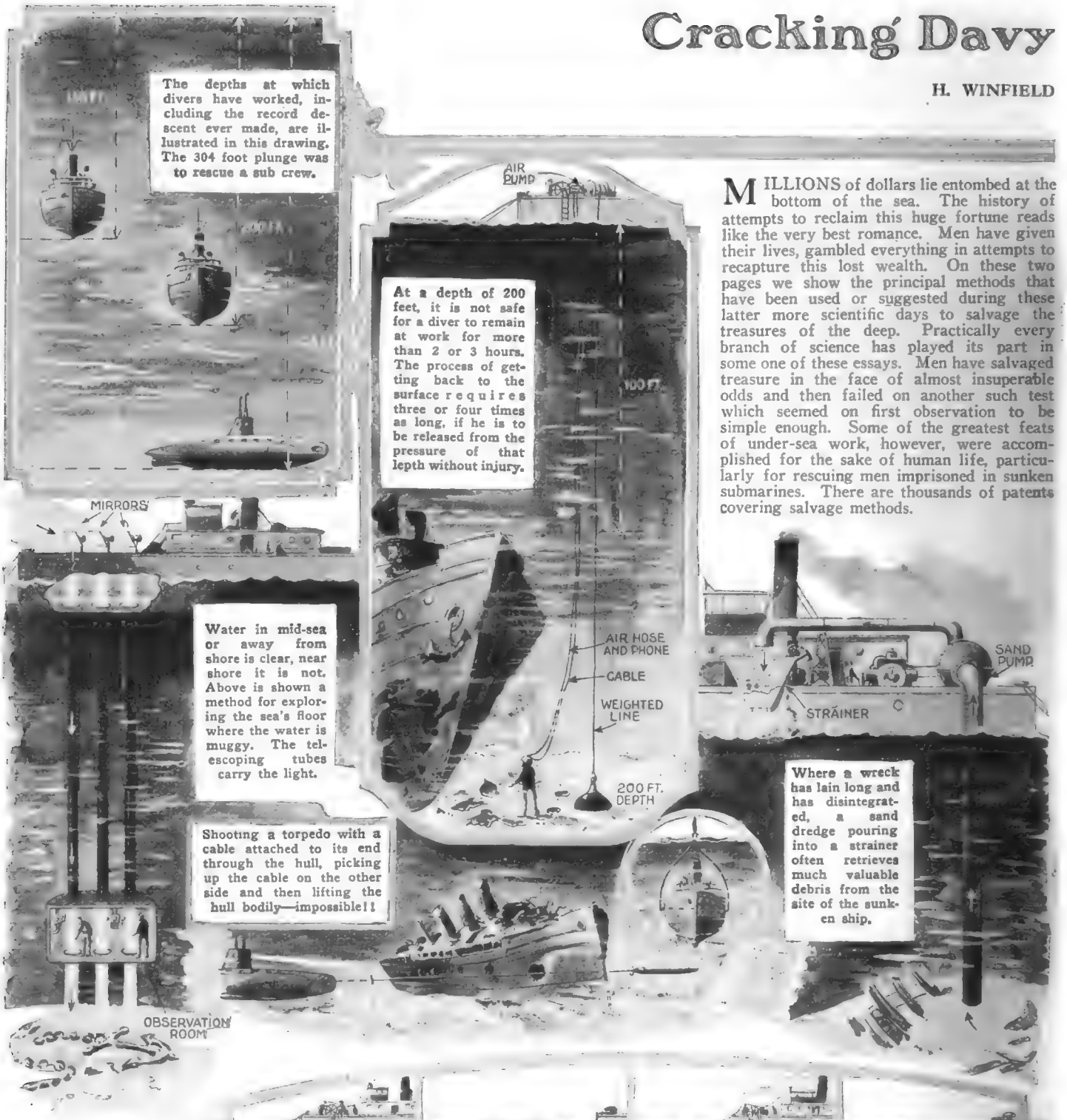
Cracking Davy

H. WINFIELD

MILLIONS of dollars lie entombed at the bottom of the sea. The history of attempts to reclaim this huge fortune reads like the very best romance. Men have given their lives, gambled everything in attempts to recapture this lost wealth. On these two pages we show the principal methods that have been used or suggested during these latter more scientific days to salvage the treasures of the deep. Practically every branch of science has played its part in some one of these essays. Men have salvaged treasure in the face of almost insuperable odds and then failed on another such test which seemed on first observation to be simple enough. Some of the greatest feats of under-sea work, however, were accomplished for the sake of human life, particularly for rescuing men imprisoned in sunken submarines. There are thousands of patents covering salvage methods.


The depths at which divers have worked, including the record descent ever made, are illustrated in this drawing. The 304 foot plunge was to rescue a sub crew.
AIR PUMP
At a depth of 200 feet, it is not safe for a diver to remain at work for more than 2 or 3 hours. The process of getting back to the surface requires three or four times as long, if he is to be released from the pressure of that lepth without injury.
100 FT.
MIRRORS
Water in mid-sea or away from shore is clear, near shore it is not. Above is shown a method for exploring the sea's floor where the water is muggy. The telescoping tubes carry the light.
AIR HOSE AND PHONE
CABLE
WEIGHTED LINE
200 FT. DEPTH
SAND PUMP
STRAINER
Where a wreck has lain long and has disintegrated, a sand dredge pouring into a strainer often retrieves much valuable debris from the site of the sunken ship.
Shooting a torpedo with a cable attached to its end through the hull, picking up the cable on the other side and then lifting the hull bodily—impossible!!
OBSERVATION ROOM

One of the most marvelous salvage projects ever brought to a successful close is that illustrated at the right. First examination proved that the strong box of the ship was incased in a veritable steel wall of twisted beams and wrecked decks. It was only reached by placing a charge of explosive near it, the diver leaving while the charge exploded, then returning, and time after time repeating the same process, until finally the wreckage was sufficiently cleared away to give access to the strong box, when another charge of explosive opened it, making its treasure accessible to the salvagers.

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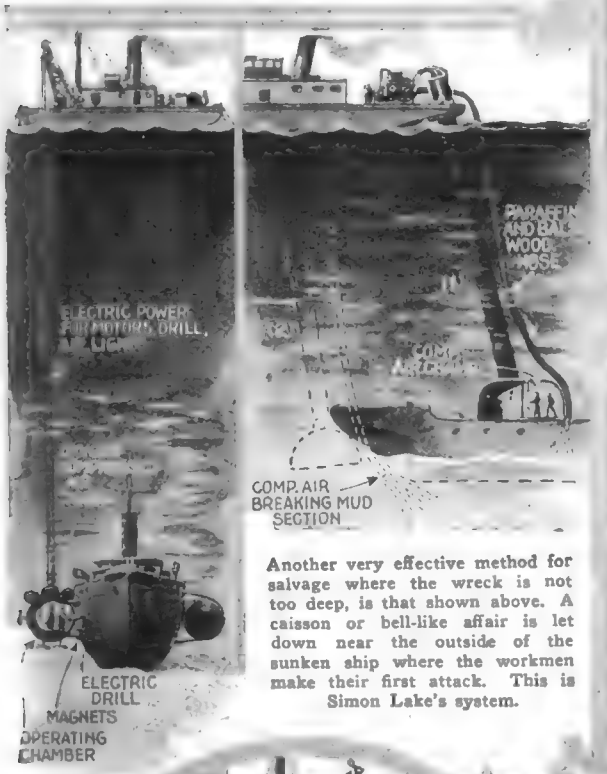
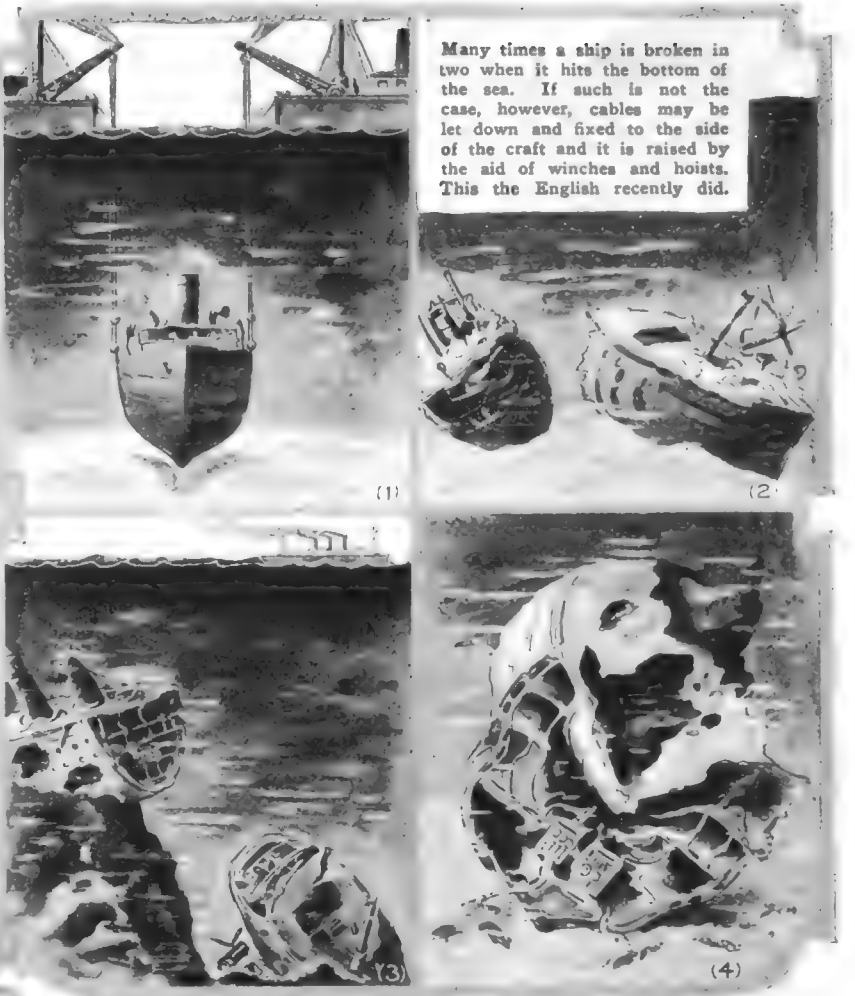
Jones' Locker

SECOR

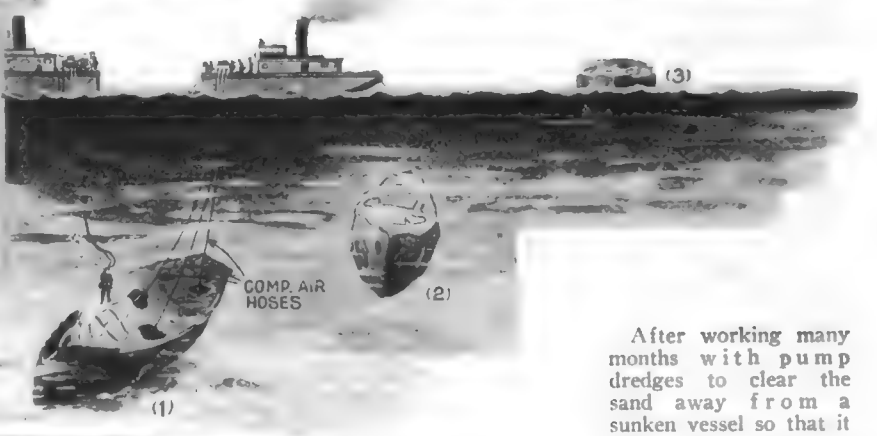


Another very effective method for salvage where the wreck is not too deep, is that shown above. A caisson or bell-like affair is let down near the outside of the sunken ship where the workmen make their first attack. This is Simon Lake's system.



Many times a ship is broken in two when it hits the bottom of the sea. If such is not the case, however, cables may be let down and fixed to the side of the craft and it is raised by the aid of winches and hoists. This the English recently did.

The Williamson water-tight tube and chamber shown here is exceptionally effective for observation.



After working many months with pump dredges to clear the sand away from a sunken vessel so that it might be salvaged, a storm came up forcing the salvagers to leave their work. When the weather cleared after a few months and the salvagers could resume their operations, it was found that the ship was broken into a thousand pieces and the remnant as before, covered with a ten foot layer of sand. Many thousands of dollars both in the original work, and in the second observation were entirely lost. Another method, however, more successful, is to make the hold of the ship tight and then fill it with compressed air, so raising it to the surface as shown above.

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Gamblers' Tricks Exposed

By MARK MELLEN

The Man Who Fooled P. T. Barnum

SOME years ago I left a French port with a partner and of course night found us in the smoke room of the big liner, playing poker. There were two Frenchmen in the game who spoke only a few words of English—but they spoke another language which my confederate and I understood.

We had been playing but a few moments when one of the Frenchmen signaled he needed a spade to make a flush and quick as a flash the other Frenchie flashed back the O. K. The trick was turned neatly and when the first Frenchman threw his cards on the table, his partner spread the fifth spade. Of course, my partner and I said nothing. Wise people never holler—they drop out of the game, cheat the other sharks, or team up and all work together.

In this instance we did the latter. I shortly held four hearts and looked directly at the Frenchman. He looked at me for an instant and flashed the "go ahead" signal. I palmed the extra card and disposed of it in the deadwood and revealed a heart flush when my four cards were spread by the Frenchman and a fifth heart added.

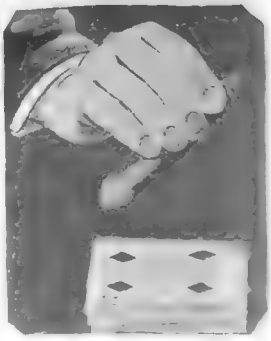
We had found one language we could both understand.

It is first necessary for the sharps to signal among themselves in a poker game. The hand in the above circle shows one of the confederates signalling for a club. The second confederate, if he has the necessary card, gives his cigar an upward tilt, indicating that all is well. In this case the indication is to fill a flush or five cards of one suit. If a straight is needed by a similar system a card above or below the one desired is shown with the finger.

After the signals have been passed across by means of the cards and fingers as in the circles at the top of the page, it is a comparatively easy matter of course to make a full hand with the aid of "spreading." If one player has a bob tailed flush, he asks his confederate for his missing card and the confederate signals yes with his cigars. The player with the flush lays his four cards on the table. The confederate takes the fifth card necessary to complete the hand, holds it back far in his palm, and then makes some such a remark as let's see them and at the same time fanning the cards out on the table and adding the fifth, thus completing the hand. I have met a great number of sharks who know how to collect the money with this method from the suckers, but I have never met one who knew how to keep it. Invariably the wise gent in one line is the fall guy in some other game.

The above illustration shows the method used in palming the card to be spread in the confederate's hand. The extra card in the confederate's hand is passed into the dead wood.

The same scheme is worked in stud poker. In such cases marked cards are used and the worker or man who reads the cards, signals his confederate what to do. The fingers on the card now reveal what the sucker has in the hole. One finger means ace, two fingers a king, etc. It is easily seen that this system allows the sharps to know exactly what an opponent has in the hole and consequently what his full hand contains.



In playing whist it is frequently a great aid to know what suit your partner would like to have you lead. This is easily arranged by unscrupulous sharps. The manner in which the cigar or cigarette is held conveys this information. In Figure 7 the signal, if used in a whist game, means "Lead a heart." The two fingers on the cigar give the "office." One finger over the cigar would "tip" your confederate to lead a spade. Three fingers over the cigar, as in Figure 8, reads to the experienced grafter, "Lead a club." And four fingers would be interpreted, "Lead a diamond." Figure 9 shows cigar held between index and second finger, with the burning end up. In a whist game this, in the land of graft, reads, "Take this trick regardless of rules as to high or low play."

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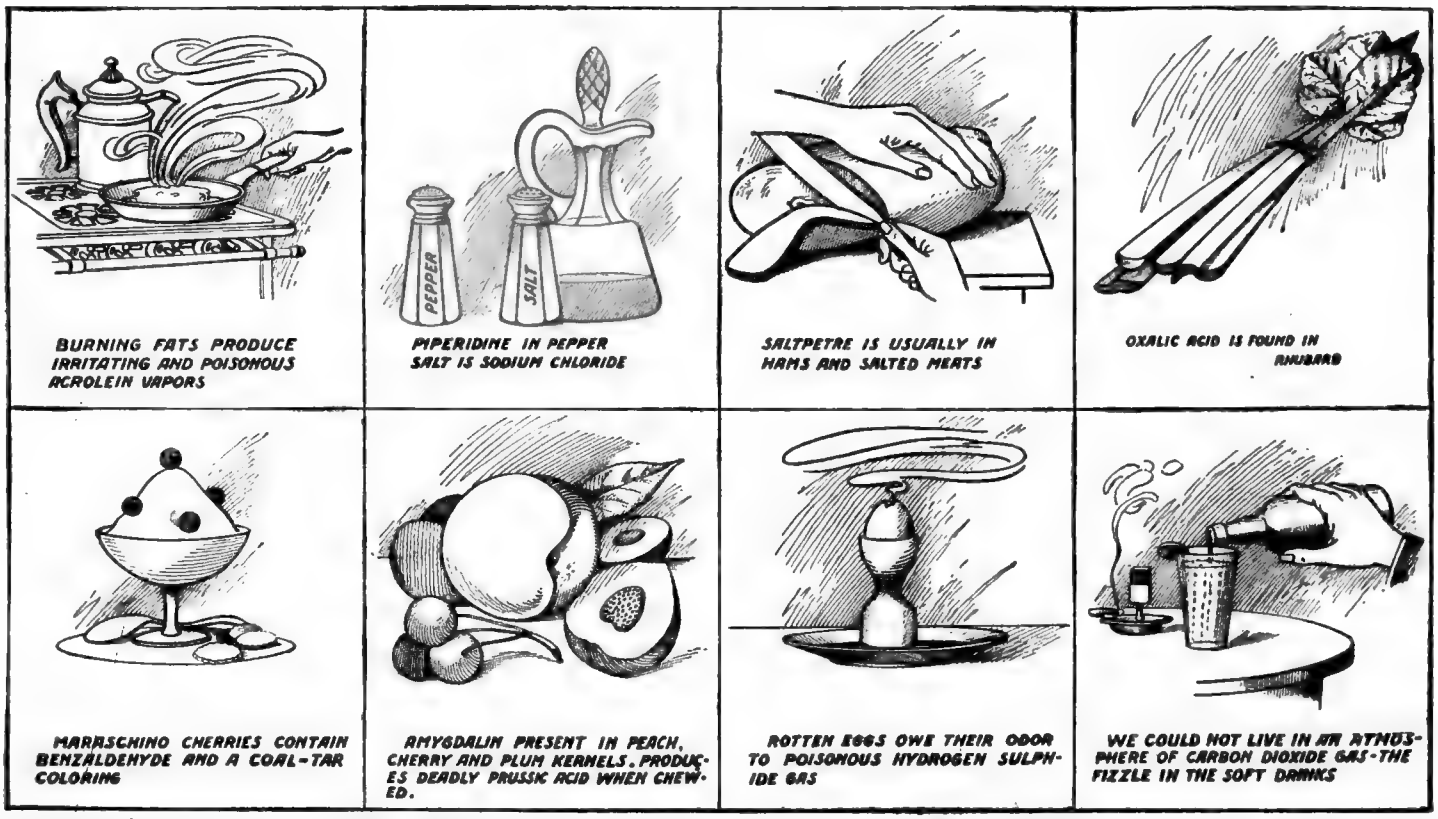
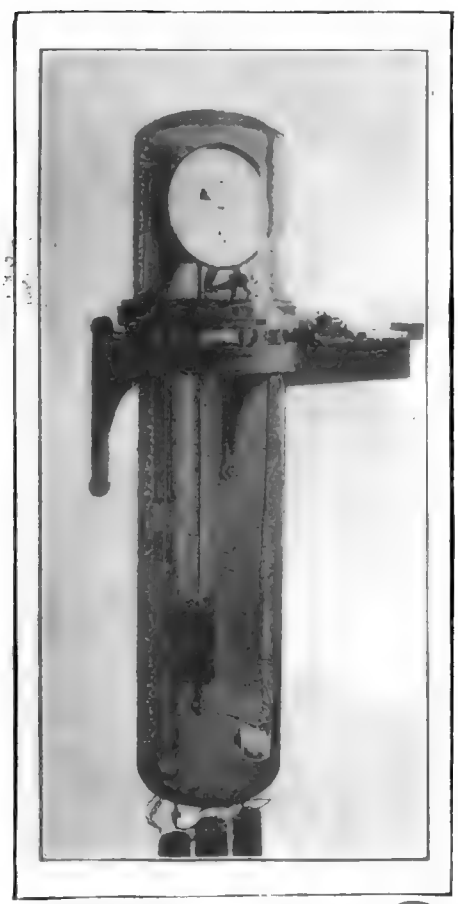
Poisons We Eat Every Day


BURNING FATS PRODUCE IRRITATING AND POISONOUS ACROLEIN VAPORS
PEPPER
SALT
PIPERIDINE IN PEPPER SALT IS SODIUM CHLORIDE
SALTPETRE IS USUALLY IN HAMS AND SALTED MEATS
OXALIC ACID IS FOUND IN RHUBARB
MARASCHINO CHERRIES CONTAIN BENZALDEHYDE AND A COAL-TAR COLORING
AMYGDALIN PRESENT IN PEACH, CHERRY AND PLUM KERNELS. PRODUCES DEADLY PRUSSIC ACID WHEN CHEWED.
ROTTEN EGGS OWE THEIR ODOR TO POISONOUS HYDROGEN SULPHIDE GAS
WE COULD NOT LIVE IN AN ATMOSPHERE OF CARBON DIOXIDE GAS - THE FIZZLE IN THE SOFT DRINKS

That we eat enough poison in a lifetime to deplete the ranks of an army may be seen by examining the above illustrations. The mere burning of fat in a frying pan produces a gas that is poisonous. In our two chief flavoring compounds, pepper and salt, there are two compounds that if used alone in any quantity would be deadly. In salted meats and maraschino cherries there are substances used in their preparation that are hardly healthy. The toxic effect of peach and cherry pits is well known. In rhubarb there is oxalic acid. We could not live in an atmosphere of carbonic acid gas which is used in the bottling of soda water.

—Raymond B. Wailes.

Precision



Beetles Pets of Scientist

An English scientist has two very singular pets. They are a pair of African Goliath beetles, one of the largest of the beetle species. In spite of their formidable size, which may be judged by comparing them with the hand that is holding one of them, they are quite tame and will come to their master's hand for bits of food. They are entirely harmless in spite of their appearance.

—S. L. Bastin.

At the left is shown the precision clock at the Case School of Applied Science, Cleveland, Ohio. It is one of the most accurate clocks known, varying only a few thousandths of a second a day. The pendulum and rod are of Invar, an alloy whose coefficient of expansion approaches zero. The clock is kept in an airtight case and is regulated by the air pressure inside the case.

—Dayton C. Miller.

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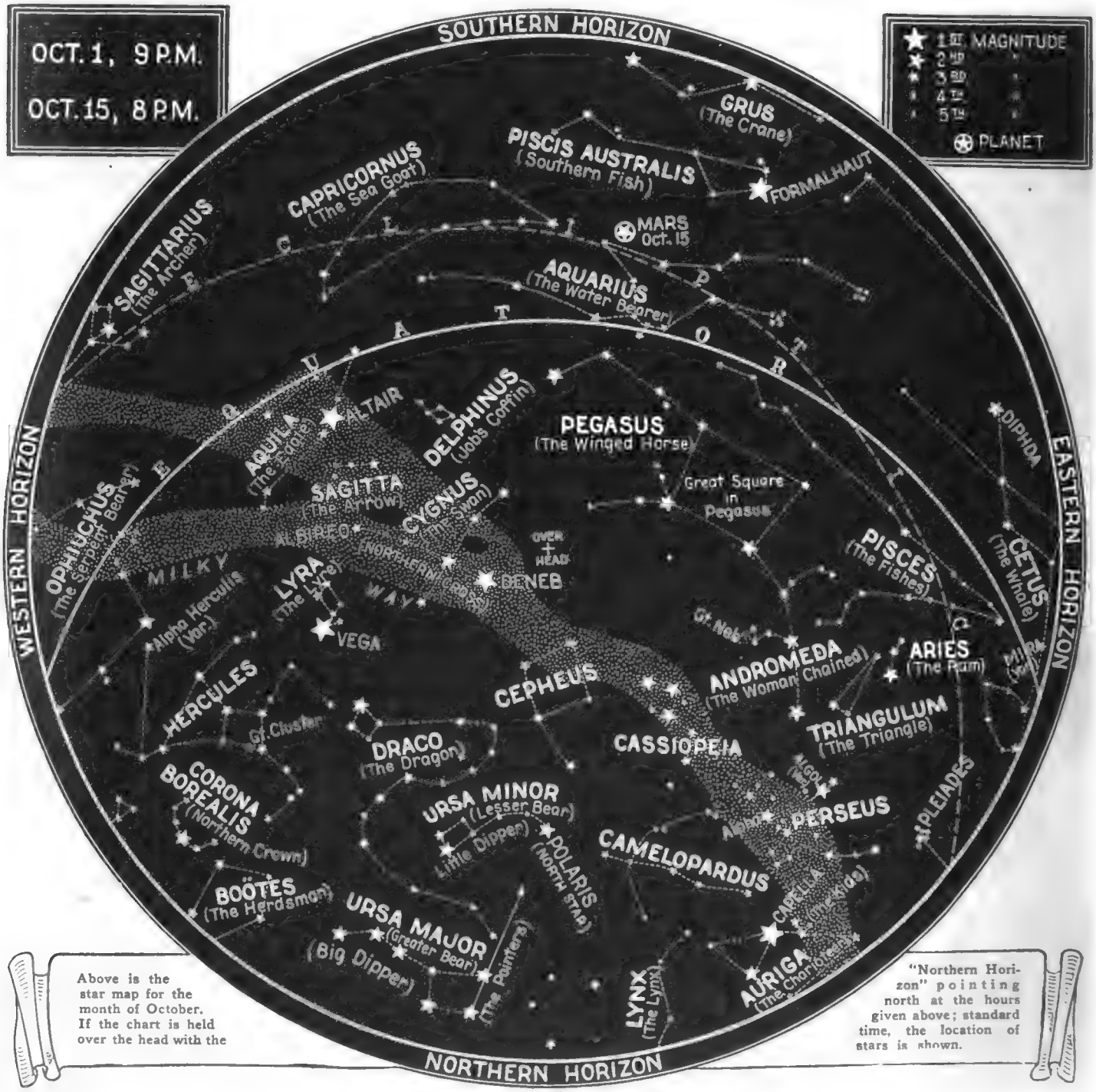

Above is the star map for the month of October. If the chart is held over the head with the "Northern Horizon" pointing north at the hours given above; standard time, the location of stars is shown.

The Heavens In October

By ISABEL M. LEWIS, M.A.
of the U. S. Naval Observatory

IN the south and southeastern part of the heavens this month we find that all of the constellations are in some way associated with water. In fact this part of the heavens was known to the Chaldeans, famous astronomers of antiquity, as The Sea. In classic times the winter solstice, which marks the most southern point in the sun's yearly circuit of the heavens was located in the constellation of Capricornus, The Sea-Goat, and the sun was in this constellation or in the constellation Aquarius, The Water-Bearer, next to it on the east, during the rainy season which probably accounts for the aquatic nature of these groups and others nearby. To the south of Aquarius is the Southern Fish Piscis Australis and to the east Pisces, The Fishes, with heads widely separated and tails bound together. Next to Pisces on the east is the huge constellation of Cetus, The Whale. There are, then, three fishes, a whale, a water-bearer with his overbrimming urn pouring forth a stream of faint stars toward the southeastern horizon, and a sea-goat in this part of the heavens, a truly aquatic assemblage!

Were it not for the presence of the brilliant planet Mars in Aquarius at this time there would be but one bright star visible in the southeastern heavens this month. Fomalhaut, the white, first magnitude star in Piscis Australis, distant from the earth twenty-five light years or one hundred and fifty trillion miles, enjoys the distinction of being the farthest south of all the first magnitude stars visible in the latitude of New York. In the latitude of Charleston, S. C. the magnificent Canopus also appears above the southern horizon for a brief period in the winter. Aside from Mars and this solitary star of first magnitude there is little to attract our attention in this part of the sky. The constellations that lie in southern skies in the belt of the zodiac on October evenings, Capricornus, Aquarius and Pisces, contain no conspicuous stars although they contain a number of third and fourth magnitude stars. Aquarius, the largest of the three groups, covers a large area in the south and southeast and can be identified by the presence in it of the planet Mars at the present time and by the little Y-shaped group of fourth magnitude stars representing the water-urn from which a stream of stars

(Continued on page 624)

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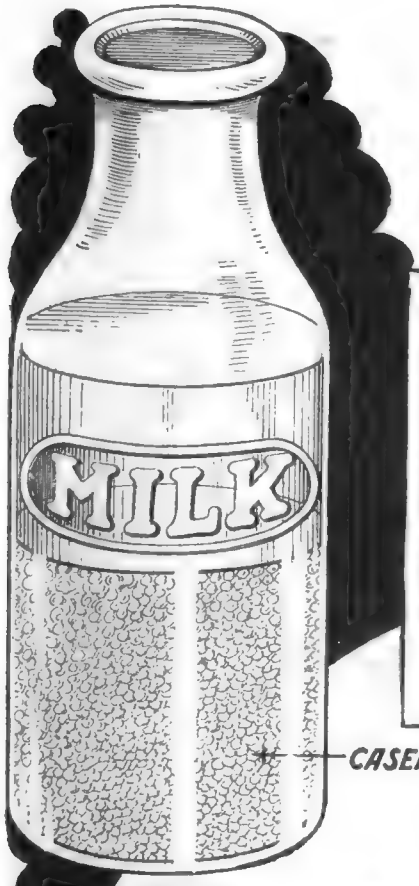
Casein and Its Use

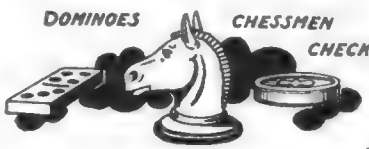
By RAYMOND B. WAILES

CASEIN, the wonder substance, is produced from milk, the cure-all. Skimmed milk is usually employed, and simply adding an acid such as vinegar, which is about 5 percent acetic acid, precipitates casein. This is also called "curd," and may form naturally even without the addition of the acetic acid. The curd is allowed to settle and is then filtered off. This curd when dried, is the commercial casein and is used in many different ways. In every day substances it is used directly. It forms the basis of many of the massage rolling creams, dissolved in borax or soda solution it yields a good paste, which is used for sizing or coating papers and is also employed in calico printing. It gives paper a high gloss. Combined with rosin and vegetable oils it forms excellent insulators. By using a filler and adding formaldehyde to the product, imitation ivory results. Articles from this product can be molded under pressure. These articles will include checkers, chessman, billiard balls, dominoes, toys, cigarette and cigar holders and vanity outfits. Many medicines or "toners" are composed almost entirely, if not entirely, of casein. If casein is dissolved in a thick hot solution of sodium phosphate and glycerine, it produces artistic bottle seals. If formaldehyde is sprayed upon them, the casein becomes very hard and water-proof. Equal parts of casein, borax and lime produce a porcelain cement if but a little water is added to make a paste of the substances. Electrolytically casein has been produced by placing carbon electrodes in milk. Due to impurities of the carbon, the product is inferior to that produced by the acid process.

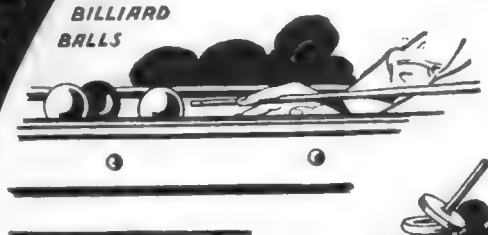


CASEIN

DOMINOES CHESSMEN CHECKERS



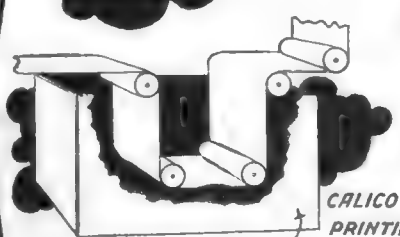
BILLIARD BALLS



CASEIN PAINTS WITHSTAND AGE

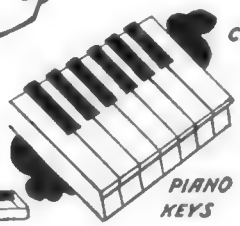
BOTTLE SEALS

PASTES, GLUES



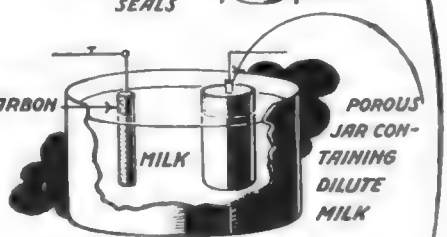
CALICO PRINTING

CASEIN-BORAX BATH



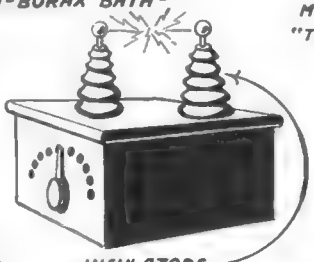
PIANO KEYS

MEDICINES "TONERS"

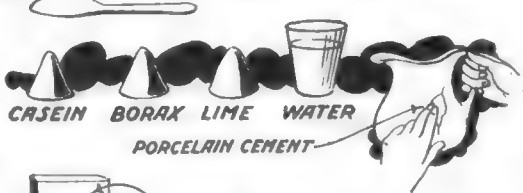


CARBON MILK POROUS JAR CONTAINING DILUTE MILK

ELECTROLYTIC CASEIN

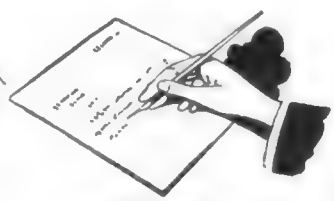


INSULATORS

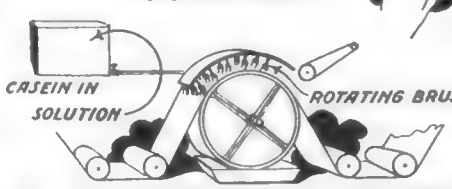


CASEIN BORAX LIME WATER

PORCELAIN CEMENT



COATED PAPERS

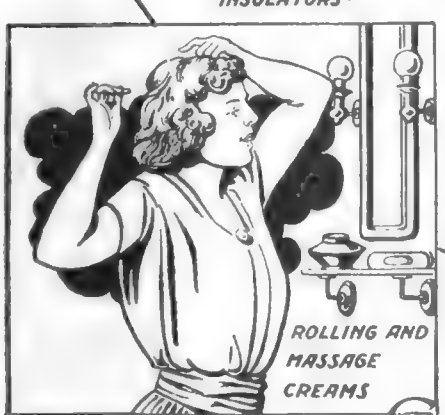


CASEIN IN SOLUTION ROTATING BRUSHES

IF WALL PAPER IS TREATED AS SHOWN HERE, AND THEN SPRAYED WITH FORMALDEHYDE, THE PAPER CAN BE WASHED

"SYNTHETIC" MILK FROM CASEIN

BAKING SODA	10 PTS	CALCIUM CHLORIDE	2 PTS.
CASEIN	75 "	MILK SUGAR	6 PTS.
BUTTER FAT	7 PTS.		



ROLLING AND MASSAGE CREAMS

CIGAR AND CIGARETTE HOLDERS

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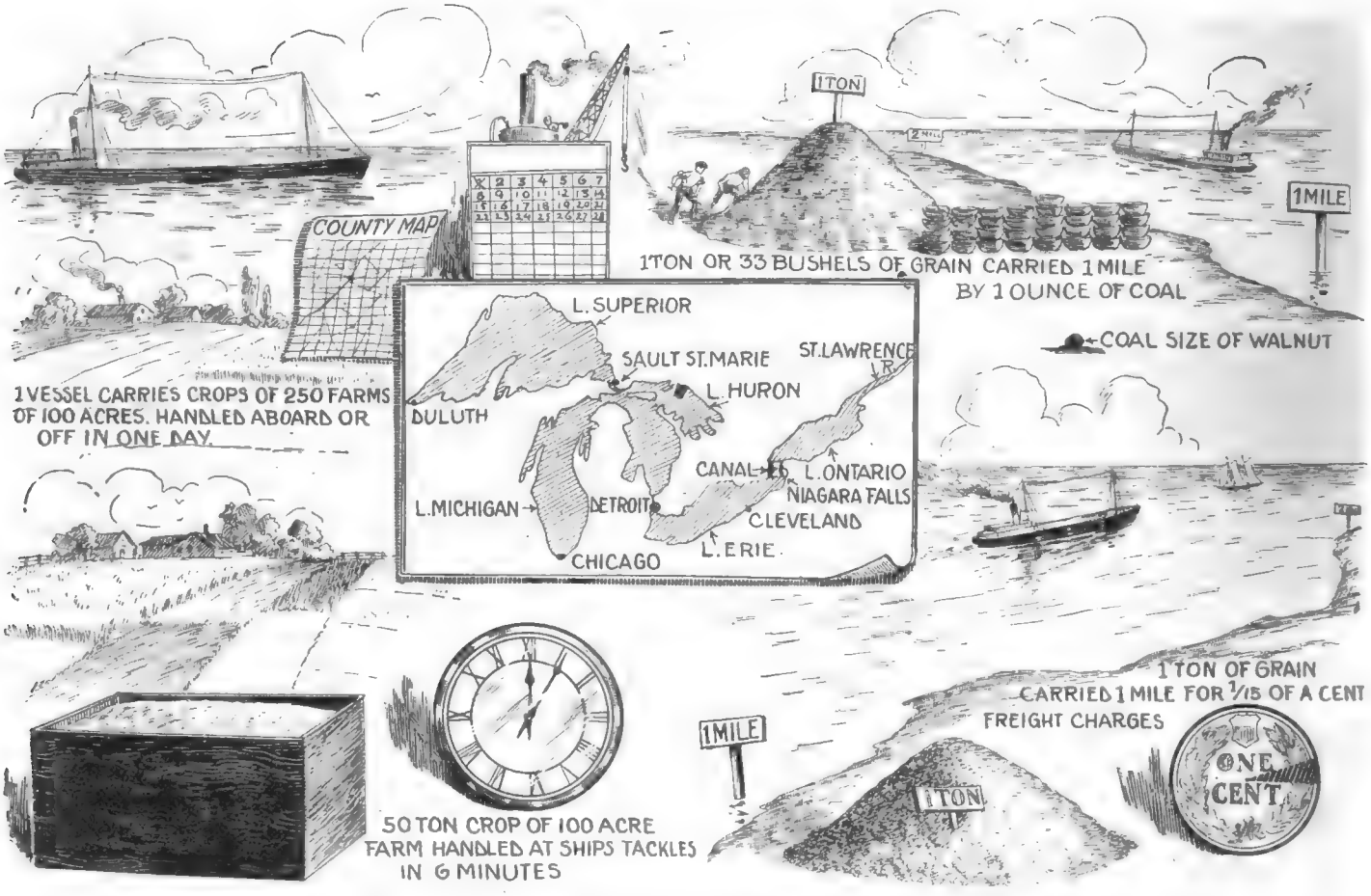
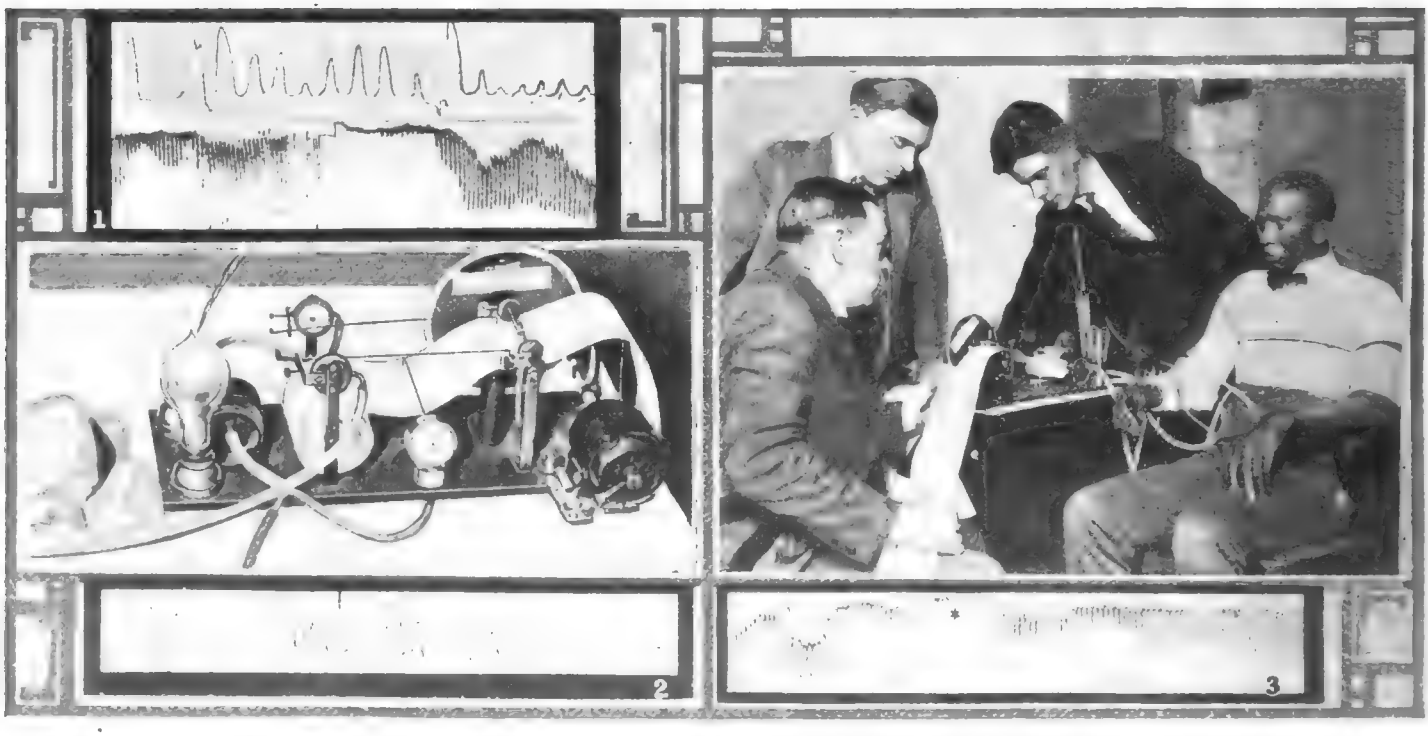
Water Transportation


1 TON
1 MILE
1 TON OR 33 BUSHELS OF GRAIN CARRIED 1 MILE BY 1 OUNCE OF COAL
COAL SIZE OF WALNUT
COUNTY MAP
1 VESSEL CARRIES CROPS OF 250 FARMS OF 100 ACRES. HANDLED ABOARD OR OFF IN ONE DAY.
L. SUPERIOR
SAULT ST. MARIE
ST. LAWRENCE R.
L. HURON
DULUTH
CANAL
L. ONTARIO
NIAGARA FALLS
L. MICHIGAN
DETROIT
CLEVELAND
L. ERIE
CHICAGO
50 TON CROP OF 100 ACRE FARM HANDLED AT SHIPS TACKLES IN 6 MINUTES
1 TON OF GRAIN CARRIED 1 MILE FOR 1/15 OF A CENT FREIGHT CHARGES
ONE CENT

Nowhere in the world may transportation be obtained as cheaply as upon our Great Lakes. Science and engineering have achieved one of their greatest victories in carrying products over these great bodies of water. The amount of merchandise carried together with the time consumed in transportation, and some interesting figures of the cost of the process, are graphically shown in the above illustration. —Jack Bront.

The Lie Detector



The old days of the "third degree" in police investigations are on their way to the realm of history. The lie detector, shown above, by measuring with the aid of sensitive indicators on a graph chart, changes in the blood pressure and respiration rate, indicate when a suspect being questioned of is telling the truth or lying. Tubes convey variations in air pressure to sensitive diaphragms which actuate needles on graph chart recorder. —A. Sloan.

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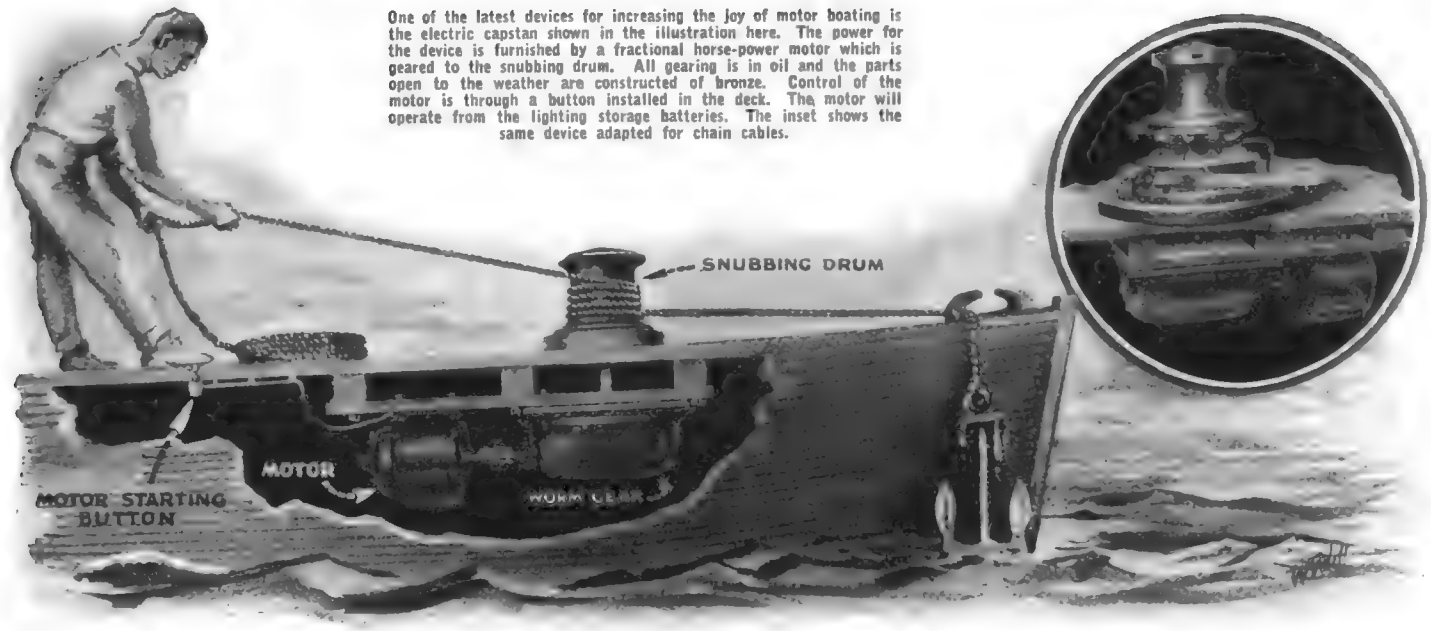
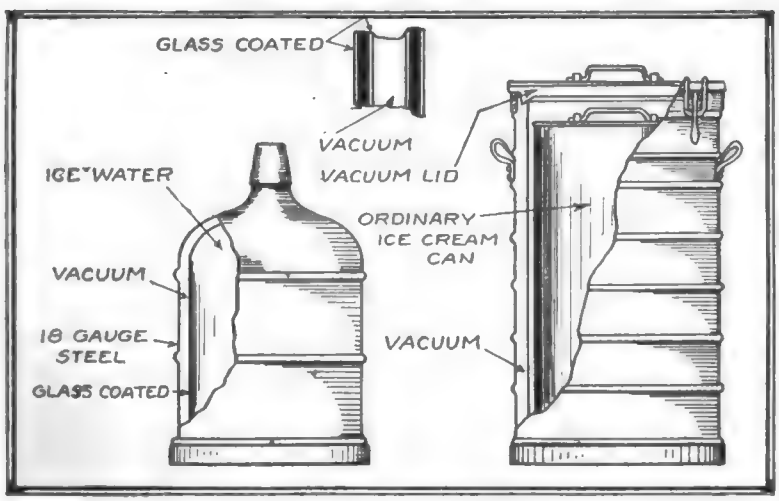
Electric Anchor Hoist

One of the latest devices for increasing the joy of motor boating is the electric capstan shown in the illustration here. The power for the device is furnished by a fractional horse-power motor which is geared to the snubbing drum. All gearing is in oil and the parts open to the weather are constructed of bronze. Control of the motor is through a button installed in the deck. The motor will operate from the lighting storage batteries. The inset shows the same device adapted for chain cables.

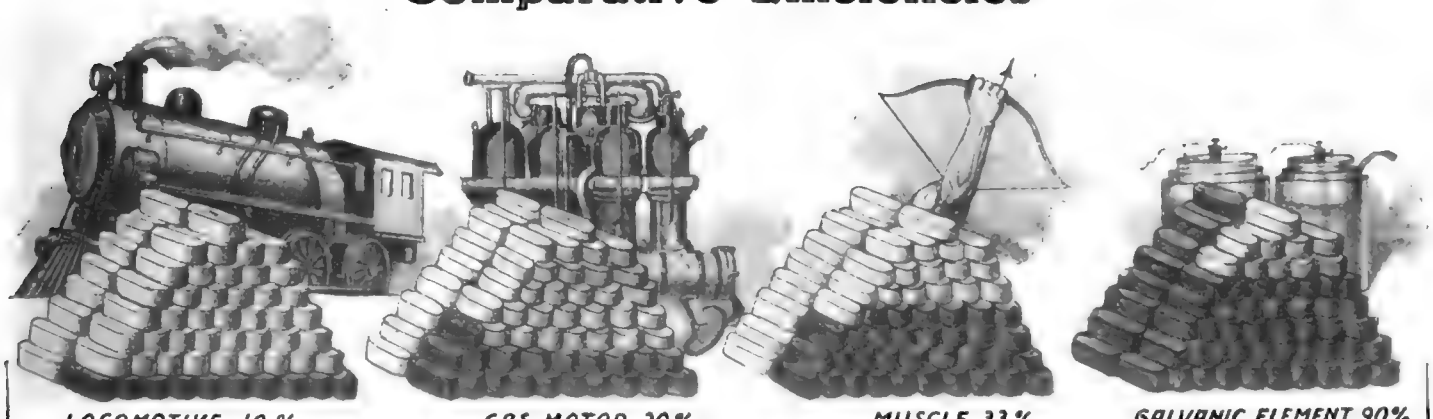


Vacuum Food Carriers

An application of the vacuum bottle for keeping foods at a certain temperature is shown here. These vessels will be found exceptionally handy by caterers in transporting foods and keeping them hot or cool over long intervals until they are served.



Comparative Efficiencies



Very enlightening are the comparative efficiencies of the various forms of prime movers shown above. From the total power producing fuel fed into the fire box of a locomotive only ten per cent of it is delivered as actual power at the periphery of the drivers. The internal combustion engine shows a bit better efficiency—twenty per cent of the fuel energy being actually transmuted into mechanical energy and delivered at the out-put end of the crank shaft. Man, considered as a machine shows the next step in the efficient conversion of fuel into energy. His muscles will deliver about 33 per cent of the energy taken into his system. The most efficient of all the forms of energy converters is, however, the galvanic cell which transmutes 90 per cent. All efficiencies shown here are over-all, that is they show comparison from fuel to actual output.—From Kosmos.

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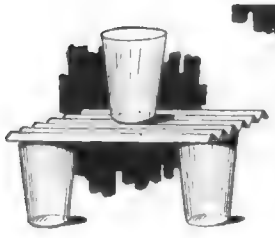
Scientific Tumbler Tricks

By WALTER B. GIBSON

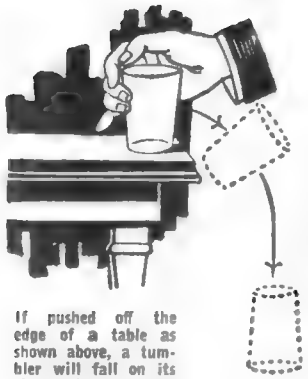
The problem in the trick shown at the left is to remove the top glass and drink the water in the bottom one without touching them with the hands. The top glass is removed with the chin as shown and the bottom one is tipped on the edge of the table with the teeth so that the water may be imbibed.

Blow through a glass of water? Impossible! Well, try it anyway. Set a lighted candle immediately behind a glass as shown and blow from the opposite side. The flame will be extinguished. The air currents join on the opposite side of the tumbler.



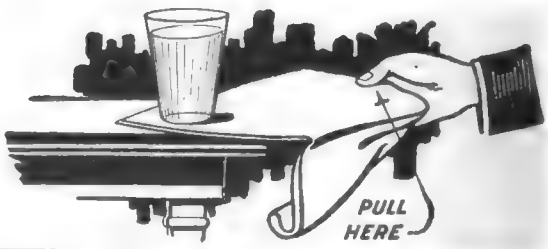
Ordinarily a sheet of writing paper supported at its ends would never support the weight of a tumbler. Corrugate it as shown above and no trouble will be experienced in making it support a glass.

Some little bit of dexterity is needed in the performance of this stunt. A full glass of water is balanced on edge on the tablecloth. The stunt is quite impossible to any but the experienced juggler unless the aid of the match stick beneath the table cloth is sought as shown in the above illustration. If this is used, however, a little practice and a steady nerve will enable anyone to perform it. The match may be placed and removed without the observers noting it.

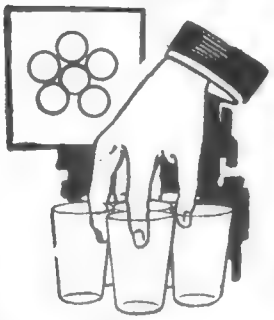


If pushed off the edge of a table as shown above, a tumbler will fall on its rim and the shock will not break it. This stunt should be practiced before public performance is attempted — and practiced over a pillow.

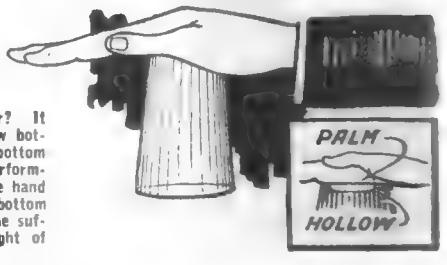
With the glasses placed as seen below, the bottom one filled with water, the question is to pour the water from B to A without handling the latter. Performance is accomplished by gripping A with the teeth and raising it to an upright position as shown and then pouring the liquid into it. Be careful of the added weight of the water, it may bring about disaster.



In the above illustrated stunt the napkin may be pulled out from under the tumbler of water by giving it a sharp jerk. At the left below is shown the method of picking up six glasses at once. Each of the fingers holds an outside one while the inward pressure holds the center



Magnetize the bottom of a tumbler? It can be done if a glass with a hollow bottom is selected and the rim of the bottom is slightly dampened before the performance of the stunt. The palm of the hand is pressed down firmly upon the bottom and the slight vacuum formed will be sufficiently strong to support the weight of the glass.



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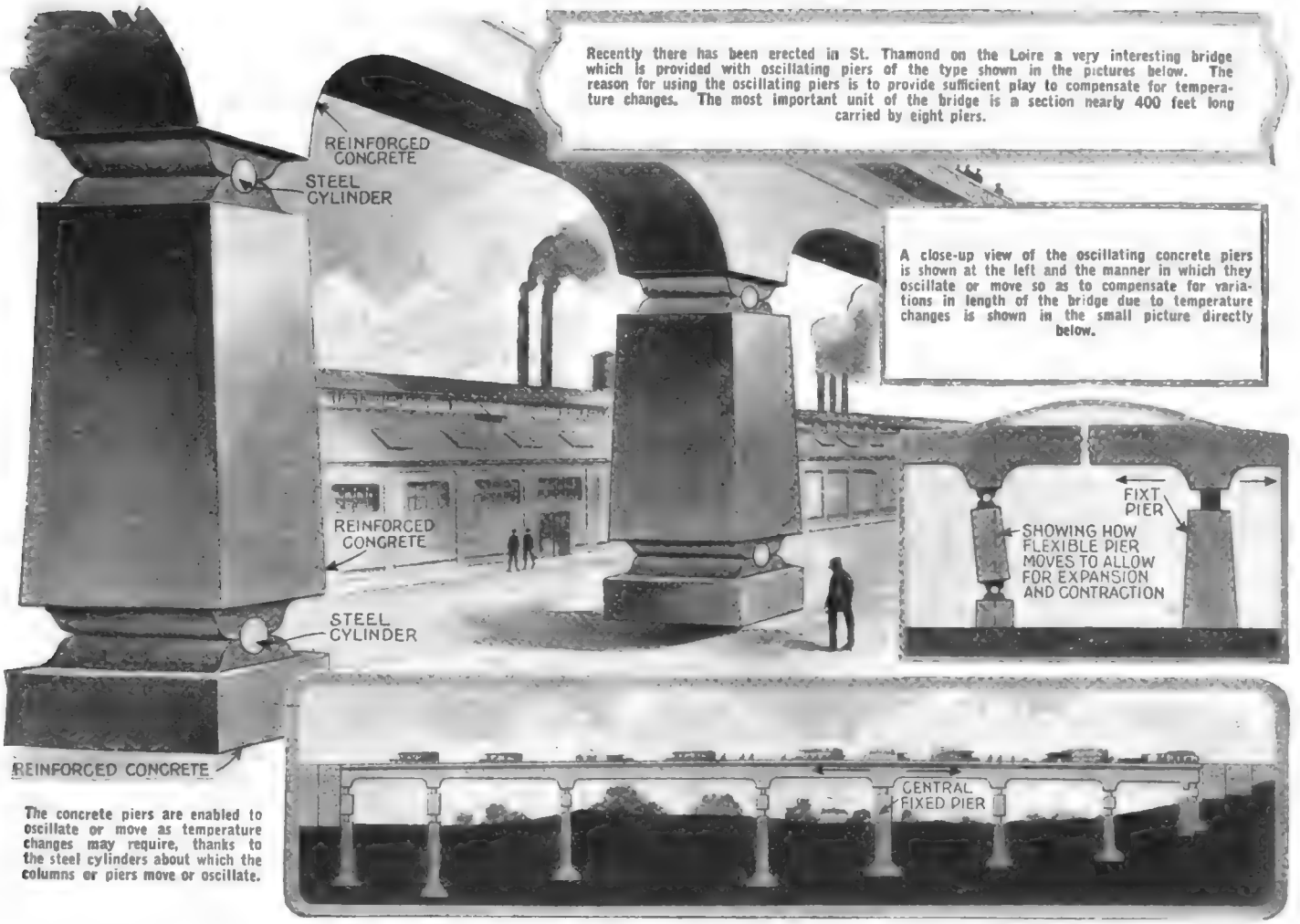
Concrete Bridge Has Oscillating Piers

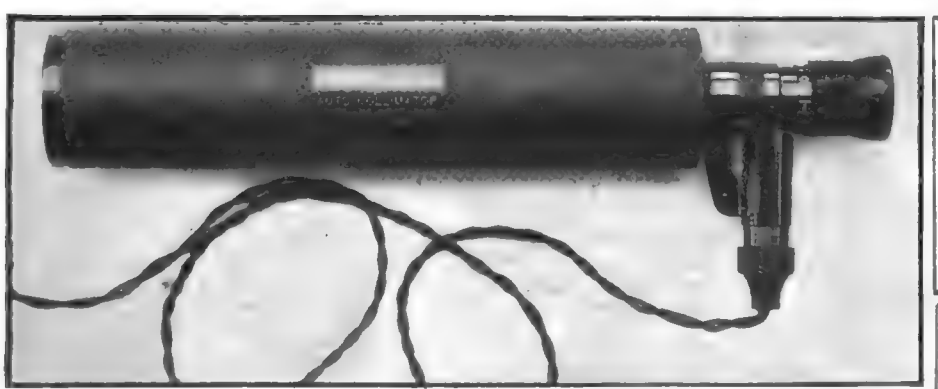
Recently there has been erected in St. Thamond on the Loire a very interesting bridge which is provided with oscillating piers of the type shown in the pictures below. The reason for using the oscillating piers is to provide sufficient play to compensate for temperature changes. The most important unit of the bridge is a section nearly 400 feet long carried by eight piers.

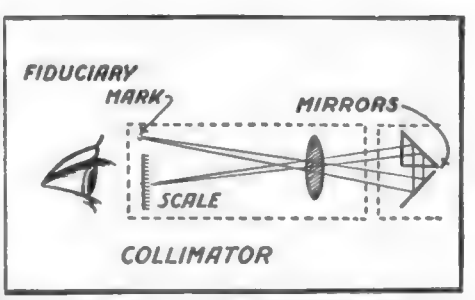
A close-up view of the oscillating concrete piers is shown at the left and the manner in which they oscillate or move so as to compensate for variations in length of the bridge due to temperature changes is shown in the small picture directly below.

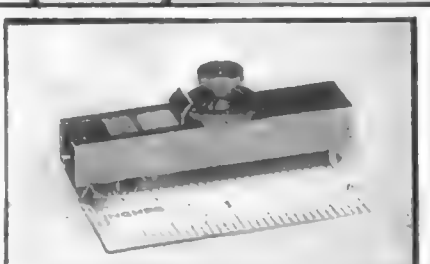


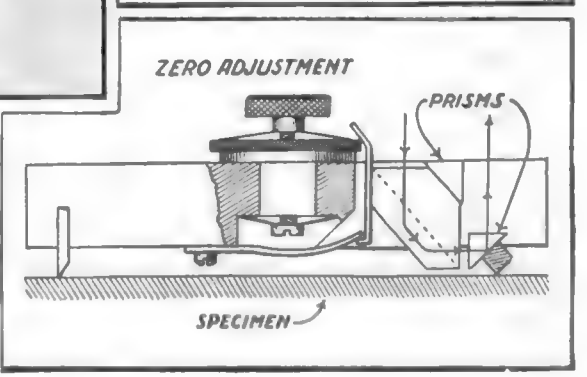
The concrete piers are enabled to oscillate or move as temperature changes may require, thanks to the steel cylinders about which the columns or piers move or oscillate.

Machine Measures One Two Hundred Fifty Thousandth Inch









THE optical strain gauge here shown, devised by the experts of the U. S. Bureau of Standards, will measure accurately to the one two hundred fifty thousandth part of an inch. It may be used for determining the stretch of steel or other materials under load. The gauge itself has two knife edges which are set into the material under test. One of these edges is in a fixed position, as shown in diagram at extreme right, while the other can turn through a small angle to allow for the change in length of the material between the two edges.

To the movable knife edge is attached a mirror which reflects back to the eye-piece the image of an illuminated mark contained in the case. The image of this mark is projected on the scale in the eye-piece, and before the load is applied the gauge is adjusted to make this mark coincide with the zero on the scale. Thereafter the scale reads directly the extension of the material to which the gauge is fastened. The gauge is very light and is adapted to the testing of thin sheets of metal or other light materials.

—S. R. Winters.

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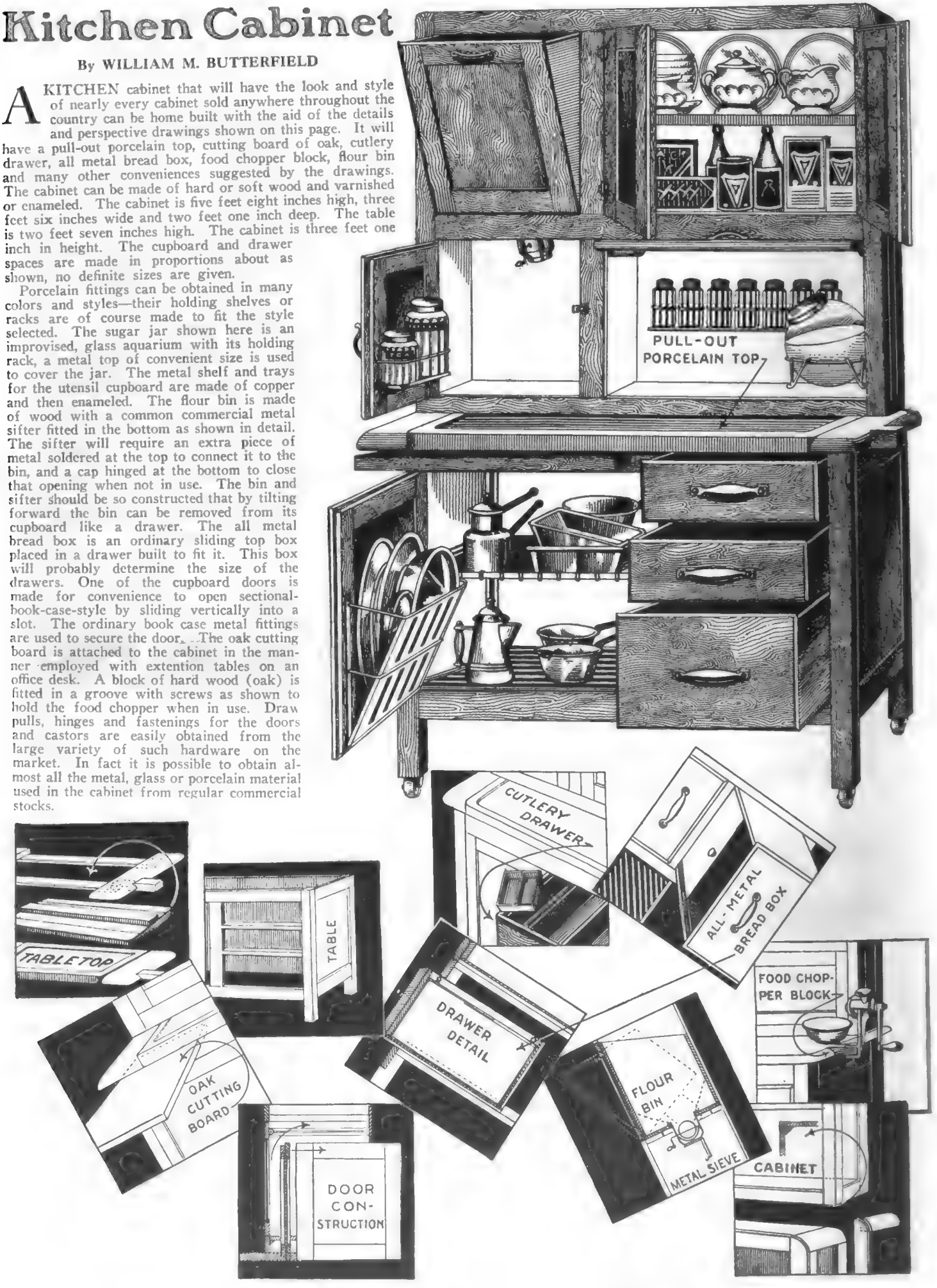
Kitchen Cabinet

By WILLIAM M. BUTTERFIELD

A KITCHEN cabinet that will have the look and style of nearly every cabinet sold anywhere throughout the country can be home built with the aid of the details and perspective drawings shown on this page. It will have a pull-out porcelain top, cutting board of oak, cutlery drawer, all metal bread box, food chopper block, flour bin and many other conveniences suggested by the drawings. The cabinet can be made of hard or soft wood and varnished or enameled. The cabinet is five feet eight inches high, three feet six inches wide and two feet one inch deep. The table is two feet seven inches high. The cabinet is three feet one inch in height. The cupboard and drawer spaces are made in proportions about as shown, no definite sizes are given.

Porcelain fittings can be obtained in many colors and styles—their holding shelves or racks are of course made to fit the style selected. The sugar jar shown here is an improvised, glass aquarium with its holding rack, a metal top of convenient size is used to cover the jar. The metal shelf and trays for the utensil cupboard are made of copper and then enameled. The flour bin is made of wood with a common commercial metal sifter fitted in the bottom as shown in detail. The sifter will require an extra piece of metal soldered at the top to connect it to the bin, and a cap hinged at the bottom to close that opening when not in use. The bin and sifter should be so constructed that by tilting forward the bin can be removed from its cupboard like a drawer. The all metal bread box is an ordinary sliding top box placed in a drawer built to fit it. This box will probably determine the size of the drawers. One of the cupboard doors is made for convenience to open sectional-book-case-style by sliding vertically into a slot. The ordinary book case metal fittings are used to secure the door. The oak cutting board is attached to the cabinet in the manner employed with extention tables on an office desk. A block of hard wood (oak) is fitted in a groove with screws as shown to hold the food chopper when in use. Draw pulls, hinges and fastenings for the doors and castors are easily obtained from the large variety of such hardware on the market. In fact it is possible to obtain almost all the metal, glass or porcelain material used in the cabinet from regular commercial stocks.



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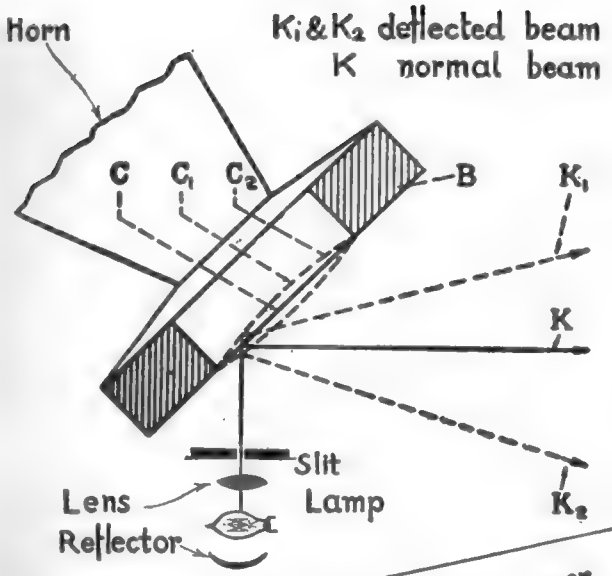
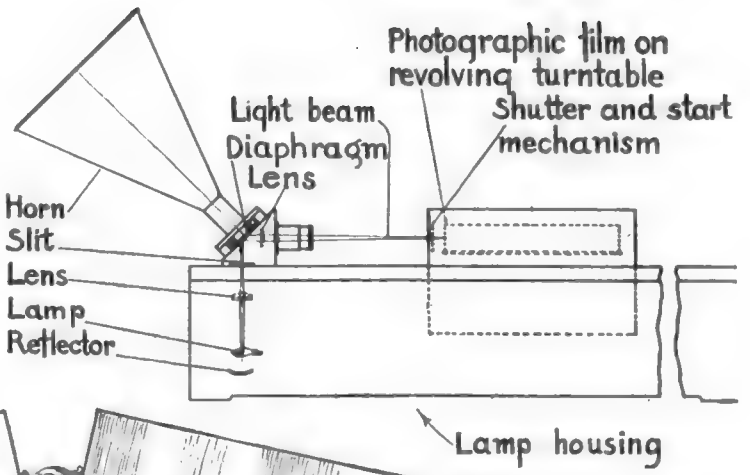
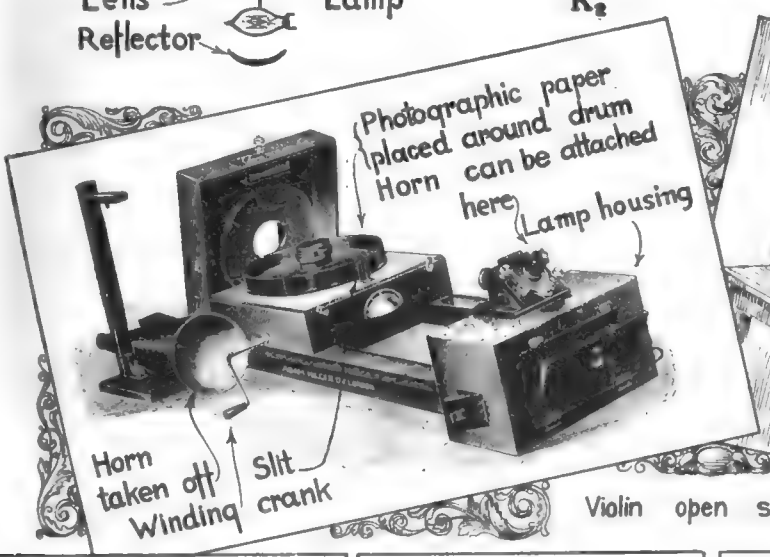
New Machine Portrays Sound

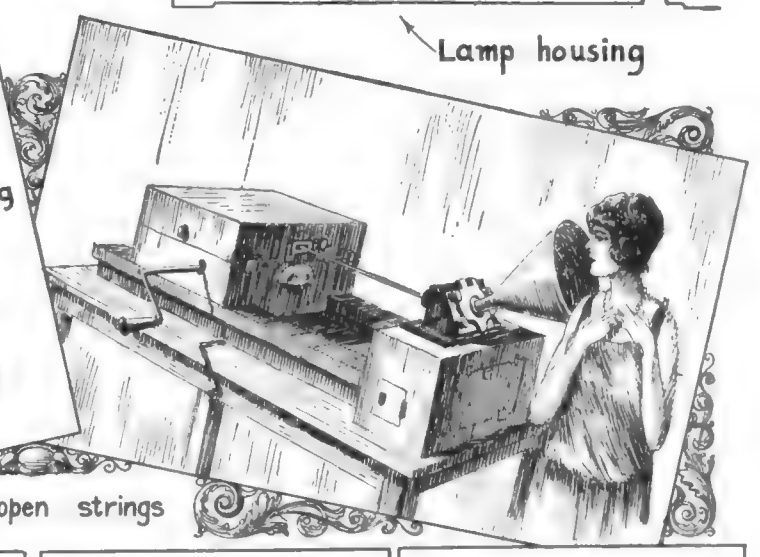
Many Acoustic Studies Now Possible.

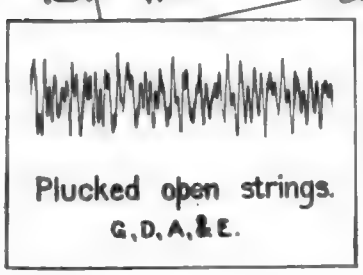
By C. A. OLDROYD

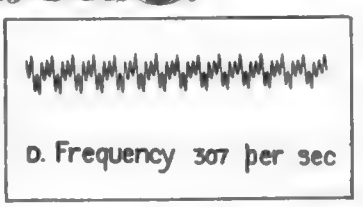


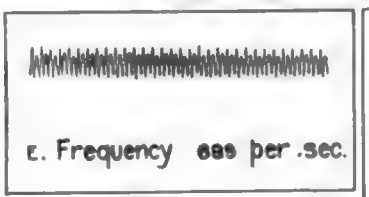


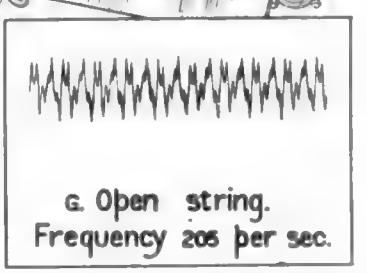


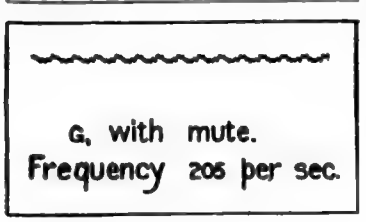


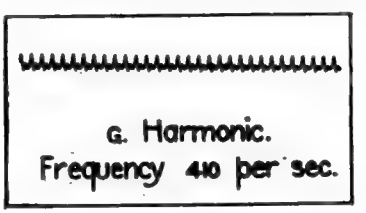


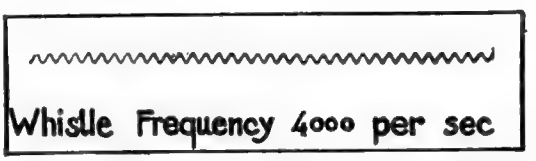


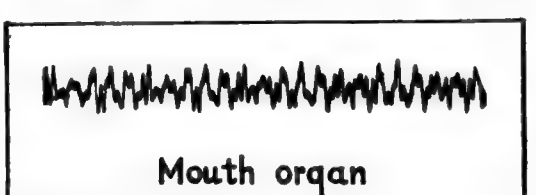












A STEP nearer perfect reproduction of sound by loud speakers and phonographs is made through a recent English invention which is illustrated on this page. It is called the Audio-meter and pictures sound in its most complicated forms, making possible comparison between original and reproduced sound for the minute study of scientists. Exterior views of the instrument and sketches showing its method of operation are seen at the top of the page. As shown, a beam of light from the lamp passes through a slit and falls upon a nickel or other metallic mirror attached to a highly resilient diaphragm C made of rubber or like material. The sound vibrates the diaphragm deflecting the light beam which is directed through lenses onto a photographic film.

AT K are shown the vibrating beams. The rotating drum carries a light-sensitized paper film past a slit through which the vibrating beam of light passes. Thus an extremely accurate picture of the vibrations appear when the film is developed. Some of these records of sounds for various instruments are shown at the bottom of the page. By making an original record with this machine and then allowing a reproducer (received radio signals actuating a loud speaker) to impinge upon the diaphragm, scientists and engineers may study closely from accurate records just what part of the musical vibrations are being dropped out in the process of transmission. Once the difficulties are made obvious, experience and knowledge will overcome them.

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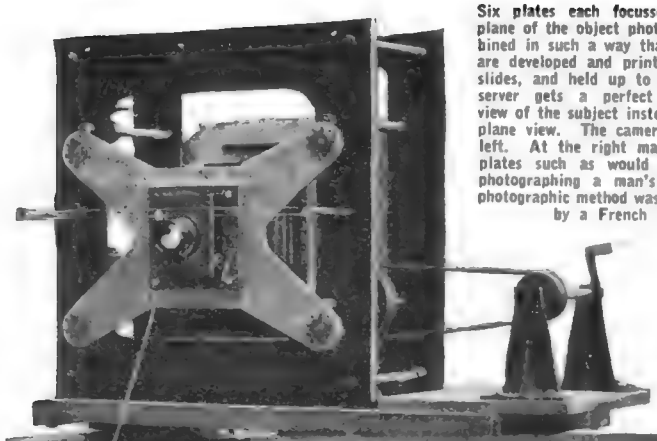
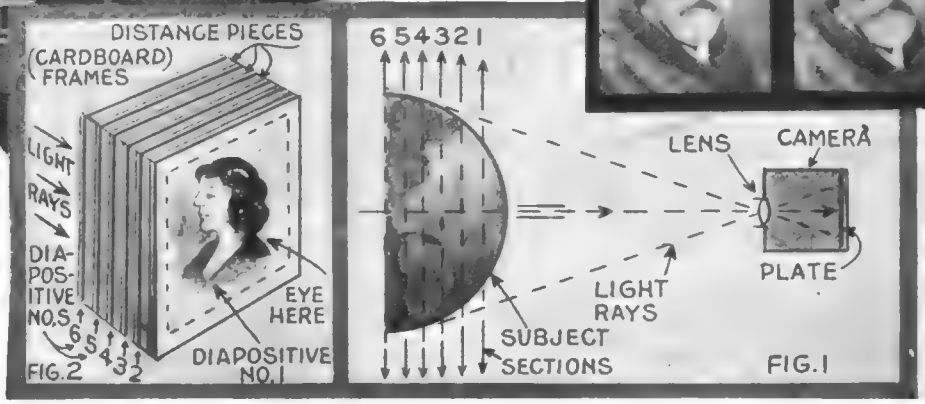
Stereoscopic Portrait Camera

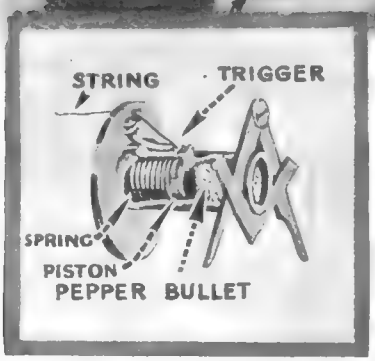


Six plates each focussed on a different plane of the object photographed are combined in such a way that when the plates are developed and printed as positives on slides, and held up to the light, the observer gets a perfect three-dimensional view of the subject instead of the ordinary plane view. The camera is shown at the left. At the right may be seen the six plates such as would be the result of photographing a man's head. This new photographic method was recently developed by a French scientist.



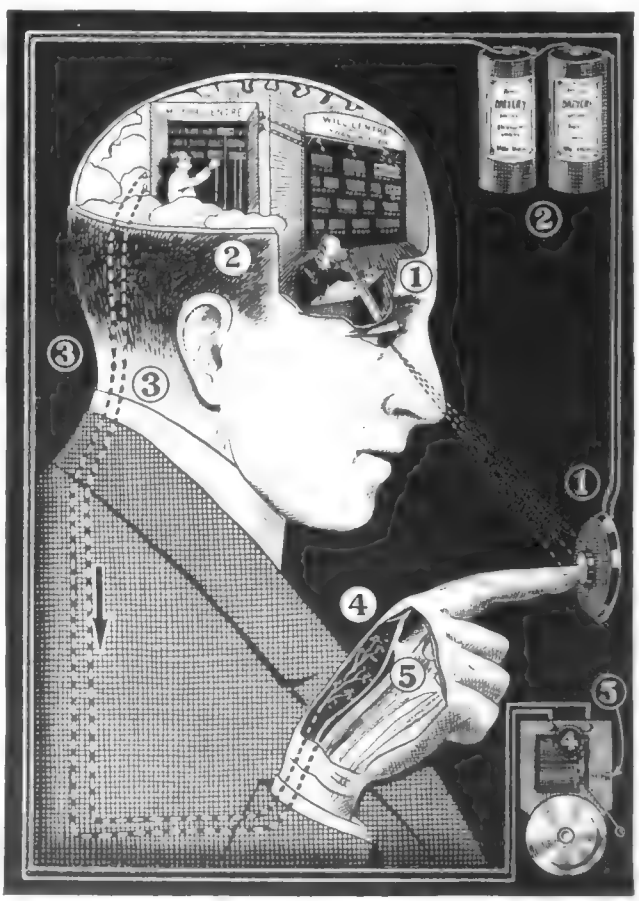
At the immediate left is shown diagrammatically the method employed for obtaining the plastic effect. The first plate is sharply focussed on the first subject section; the second on the second, and so on. Each plate brings out sharply only one particular plane in the subject. At the extreme left is shown the method used for assembling. When the plates are arranged, registered and held up to the light, a perfect image appears.—C. A. Oldroyd

Pepper Gun



In these days of frequent hold-ups the little device illustrated above will find a happy reception with those who have to carry large sums of money, and who do not care to tote a gun. The device is extremely simple. Hiding behind an ordinary lodge emblem is a barrel which is loaded with red pepper, which may be fired into the eyes of an assailant by throwing up the hands. The pepper is ejected by means of a stout spring and plunger. Its presence is not noted ordinarily and the firing strings may be carried through the sleeves in such a way as to make no interference with the regular arm motions. Suggested by William Favini.

Nerve Analogy



At the right is illustrated an extremely apt double analogy showing plainly the various functions of the nerves and brain in connection with a sight impression and a willed movement. The operator at the will center sees the push button on the wall "1" and gains a sense impression. A definite impression is transmitted to the motor center through the agency of the will. The motor center "2" corresponds to the battery "2" in the electric bell circuit, while the push button corresponds to the will center "1" since it controls the action of the remainder of the circuit. From the motor center the desire of the will is transmitted to the muscles of the hand over the motor nerve "3." These nerves terminate in motor nerve endings, "4", which translate the force of the will into action of the muscles "5." The two wires from the battery to the bell correspond to these motor nerves, carrying power from the battery which is under control of the push button. "5" represents the muscles actuated by nerve excitation, while "5" again represents the bell proper, actuated by the magnets.

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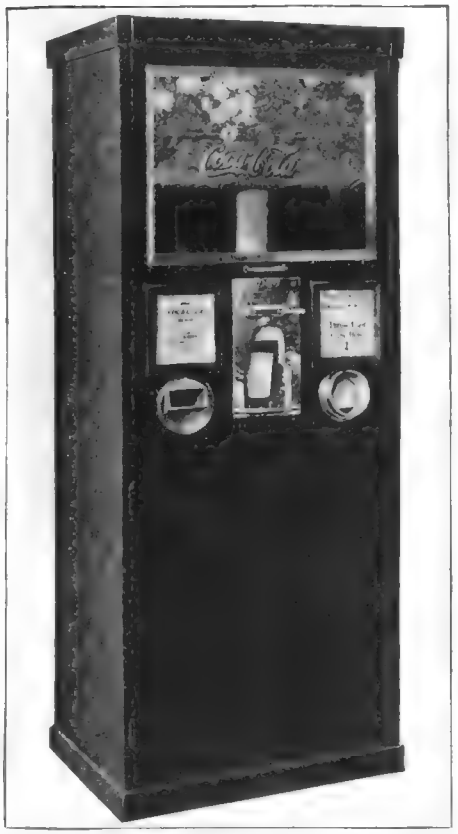
Drinks!

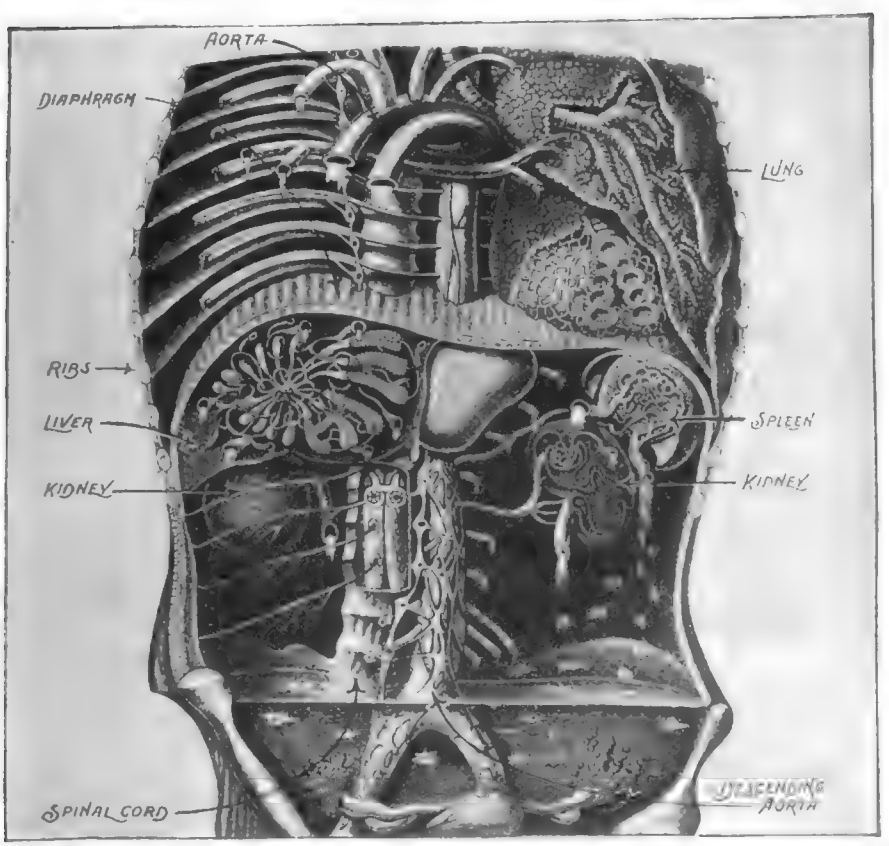


This is the latest in slot machines. If you are thirsty, simply put a nickel in the slot, turn the lever and wait for the results. A paper cup will fall in place, the syrup of the drink will run into it followed by carbonated water. A complete drink, and just as good as if the "soda squirt" had mixed it by hand.—Eric Dime.

Natural Designs from Ferns

Beautiful and not too complicated embroidery designs may be made from the natural forms of the shoots of tender plants as they appear in the early spring-time. This is a good English idea and is used quite extensively there. The young miss, in the picture, is shown putting the final touches to a piece of work, the design of which was taken from the braken fern. A photo of the original fern is shown at the right.—S. Leonard Bastin.

BODY AS AN AQUARIUM



Through the arch of the great aorta (the heart removed) fifteen quarts of blood pass every minute. The lungs supply the blood with oxygen required for the birth of blood cells in the spleen. The kidney acts as a filter—the waste products pour through it.—Das Leben des Menschen.

BULLET-PROOF

In view of the severe duties falling on German police during the recent uprising and revolutions, the bullet-proof vest and helmet shown have been given them as a means of protection. They are made of small iron squares on the order of chain armor.—Dr. H. Becher.

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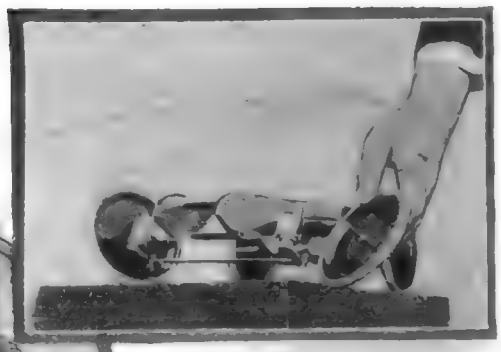
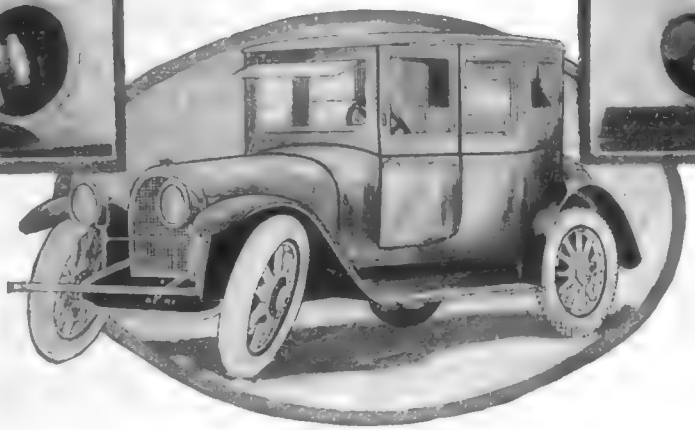
Cutting Corners Easily

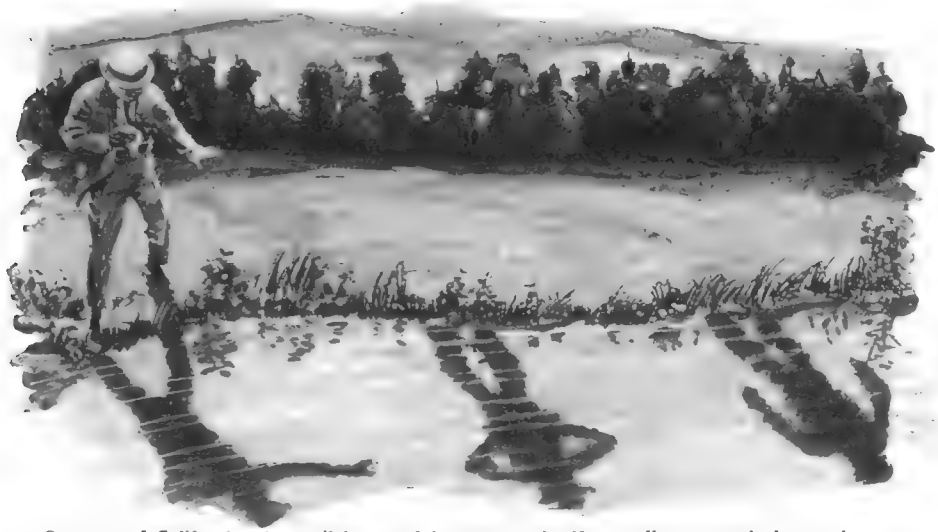




The speed at which automobiles are able to cut corners will be greatly increased by the use of a new device recently perfected by Wm. E. and Elmer T. Cox of San Francisco. By making a new steering knuckle, which tilts the front wheels in the direction of the turn, the centrifugal strain due to curve is greatly reduced. A model of the device is shown above and to the right.

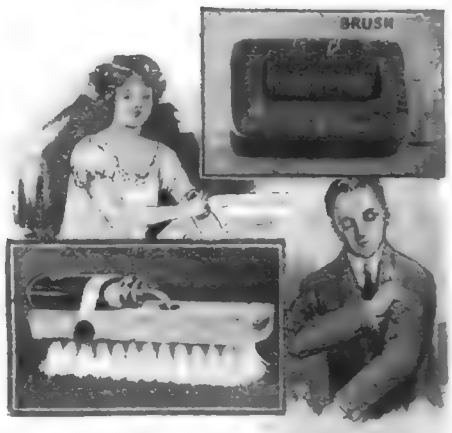
An added advantage of this new steering device lies in the fact that the position of the front axle as regards height from the earth, remains always the same no matter whether the car is taking the turn, standing still, or running straight. The knuckles are made of such a size and strength as to withstand easily any strain which might be thrust upon them by the force of the car taking a sharp turn. —Charles W. Geiger.

Shadows that Stay



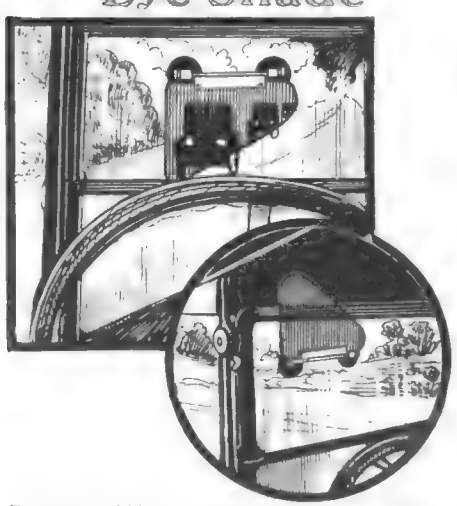
In parts of California where oil is stored in great pools, if you allow your shadow to be cast on one of these pools for a little time and then move away, the shadow will remain. The explanation is simple. The heat of the sun causes gas to rise in minute bubbles in the oil. The shadow cools a part of the surface, decreasing the gas formation, causing a difference in diffraction.

Brush



For cleaning clothing the brush illustrated above is exceptionally useful. The cleaning material or liquid soap is carried in the machine oil can, the spout of which feeds into the center of the brush bristles. The flow is forced by pressing the top of the oil can, thus squirting the mixture into the brush.

Eye Shade



For automobilists driving at night, the device illustrated above made of green celluloid, attached to the windshield with suction cups, will be found exceptionally advantageous when driving past glaring headlights. The driver can interpose this protector between his eyes and the lights by shifting his head a bit.
—G. E. Manning.

It Catches Attention!

BOY'S HAND
CARD
BASE OF SPIRAL SPRING GOES THROUGH HOLE IN CARD. HELD IN PLACE BY ADHESIVE TAPE ON BACK OF CARD
DIRECTION OF VIBRATION OF BUS
"Gee! I like 'em!"
They Contain the Body Building Food Elements

This device has been installed on the Fifth Avenue busses in New York City and has made a great hit with advertisers and public.

No advertising catches the attention of observers so well as movement. This fact has been practically applied in the device shown here. The moving hand is fixed to the card with a coiled spring. The device is installed in a moving vehicle, where vibration causes the hand to shake.

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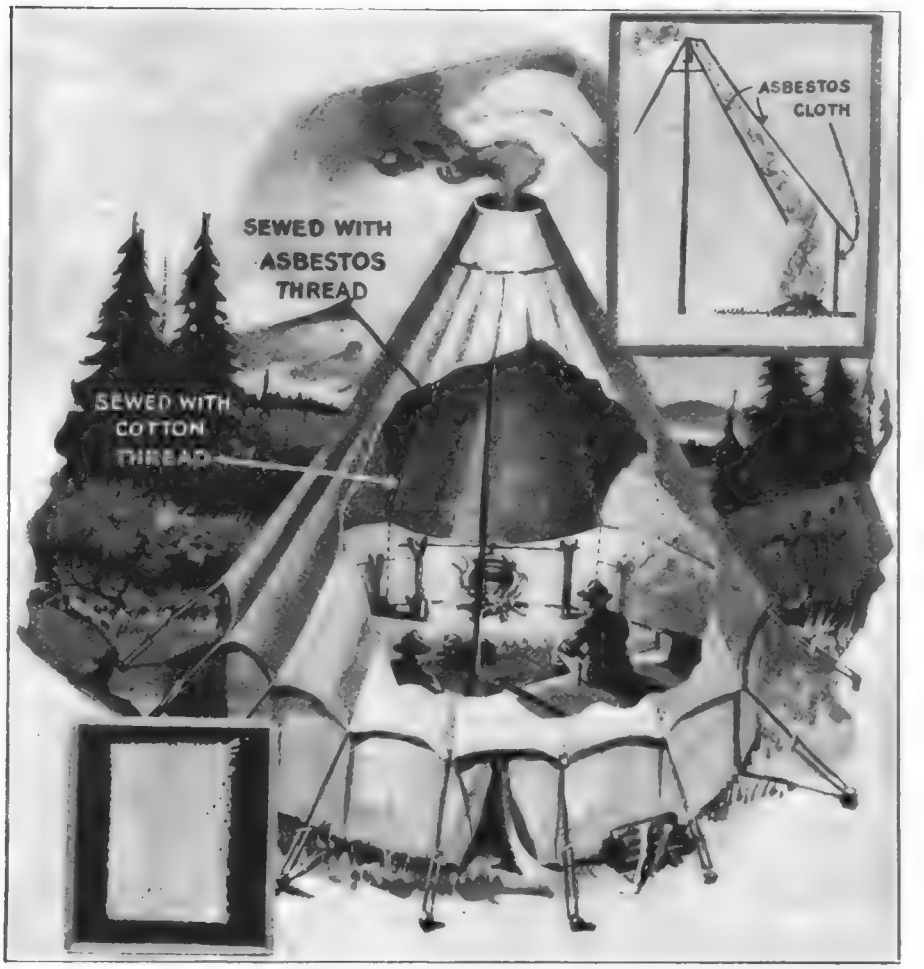
Surfacer

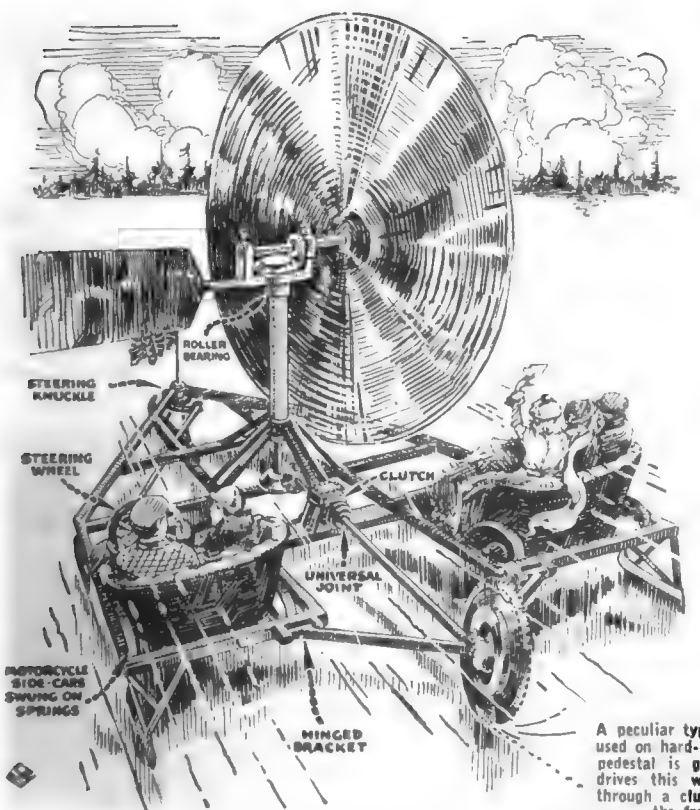
The illustration above shows a device for resurfacing old floors or putting a smooth finish upon newly-laid floors. The device is light enough to be operated by one man and runs from the ordinary house lighting circuit. A sufficiently powerful motor drives rollers, over which runs an endless belt of specially designed flexible material, the outer surface of which is coated with an abrasive. The results are said to be excellent and floors can be surfaced very quickly.

Tent Fire-Place



The tent illustrated at the right is designed for winter camping. One section of the tent is made of asbestos cloth and a second section is sewed in place as shown in the insert at the right. Smoke is carried up through this space as through a chimney. —George Arthur Luers.

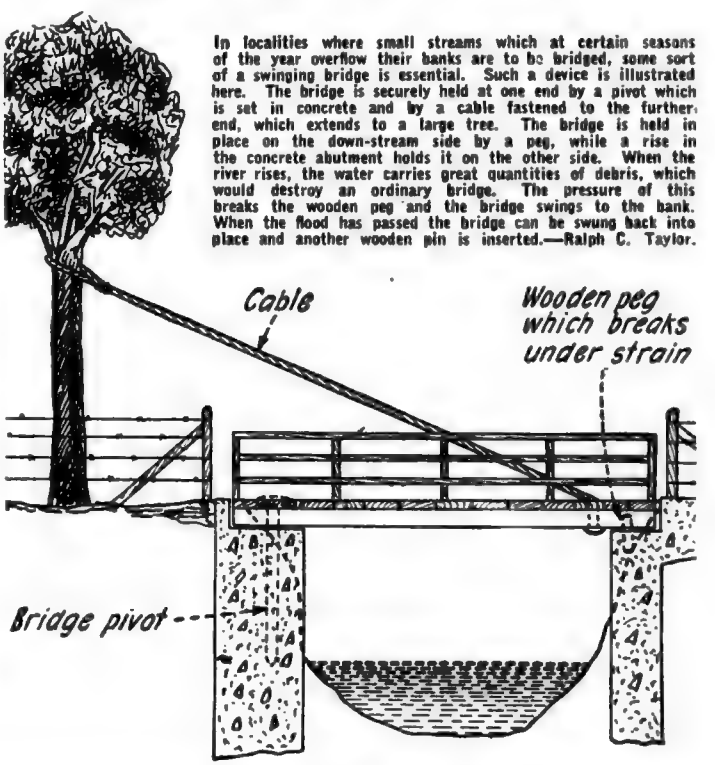
Wind Driven Sled



A peculiar type of pleasure sled for use preferably on ice, although it could probably be used on hard-packed snow, is shown at the left. A large windmill mounted on a revolving pedestal is geared to a toothed wheel located at the back of the vehicle. The wind drives this windmill and the power thus generated is delivered to the driving wheel through a clutch and universal joint. The vehicle is steered by means of one runner in the front, and the windmill always faces the wind, because of its rear vane.

Swinging Bridge

In localities where small streams which at certain seasons of the year overflow their banks are to be bridged, some sort of a swinging bridge is essential. Such a device is illustrated here. The bridge is securely held at one end by a pivot which is set in concrete and by a cable fastened to the further end, which extends to a large tree. The bridge is held in place on the down-stream side by a peg, while a rise in the concrete abutment holds it on the other side. When the river rises, the water carries great quantities of debris, which would destroy an ordinary bridge. The pressure of this breaks the wooden peg and the bridge swings to the bank. When the flood has passed the bridge can be swung back into place and another wooden pin is inserted.—Ralph C. Taylor.



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When Is Moon Biggest?

The old argument concerning the apparent decrease in the size of the moon as it rises above the horizon, is settled here again.

Another proof is to measure the angle of the moon with a pea when near the horizon and when high in the sky. Both measurements will be the same.

The distance between the earth and the moon is shown above. The moon looks larger at the horizon because it is compared with terrestial objects. A card held before the eyes to shut out near objects proves it.

Above are shown methods of comparing the moon's size with objects on earth. The moon appears the size of an ordinary dinner plate at 100 feet from the observer or approximately the same size as a wash-tub at 300 feet.

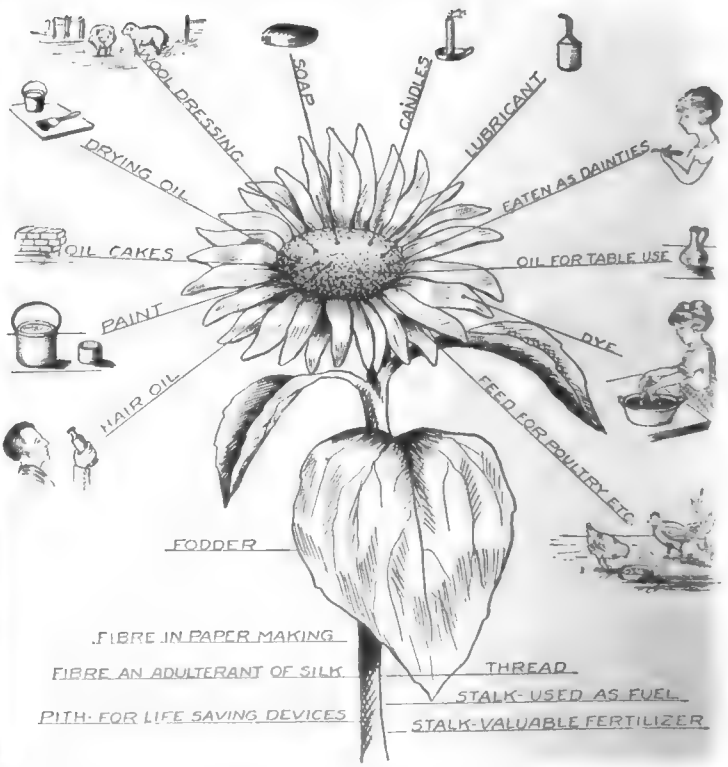
—C. T. Dahama, Ph.D.

Photographing Birds

The humming bird is the most difficult of all winged creatures to photograph. The photograph above was taken using a high-speed focal plane shutter camera, actuated by a string pulled at a good distance away from the camera. The shutter was working at one thousandth of a second.

—Kenneth Smith.

Sun Flower Uses



The wide and diversified uses to which products of the sun flower may be put are graphically shown in the above illustration, which needs very little explanation. Most of us are acquainted with the large grains of sun flower seed found in most commercially prepared chicken feeds. However, this is one of the smallest sun-flower by-products.

—Bessie Statler.

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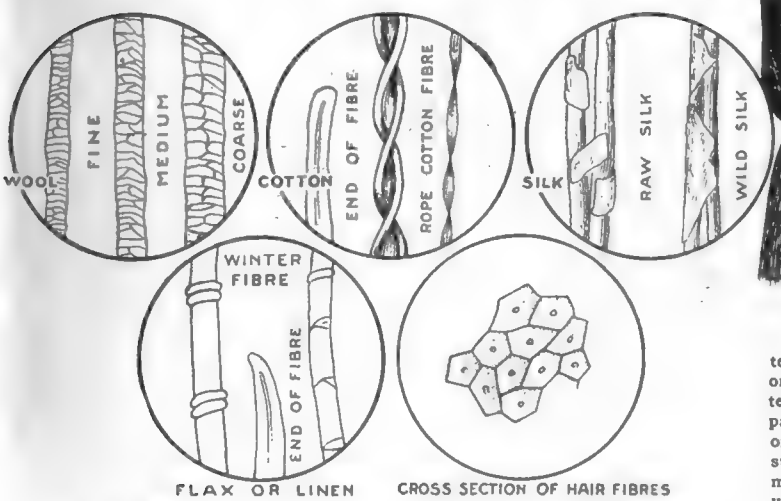
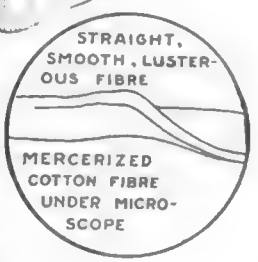
Are Your Clothes Made of Good Material?

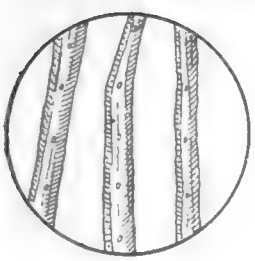
Can You Recognize Cotton, Silk and Wool?

By ISMAR GINSBERG, BSc., Chem. Eng.

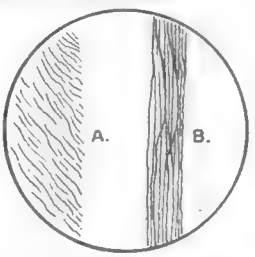


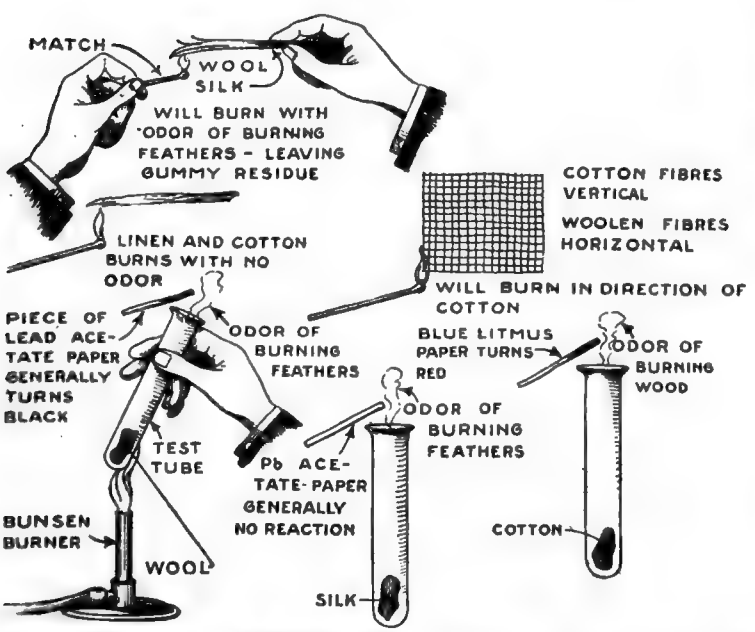
EW people in buying their clothing know exactly what tests to apply to the material in order to ascertain its quality or texture. The illustrations on this page show graphically a number of tests, as well as several microscopic studies of various fibres used in the manufacture of clothing. Practically all wearing apparel—all cloth for that matter—is made from one of four chief substances, namely, wool, cotton, silk, flax or linen. A detailed study of these will give the reader a fair idea as to their properties. Aside from the regular cloths woven from each type there are on the market dozens of combinations of the originals, as well as numerous artificial weaves, made from chemically treated substances. In the circle above and to the right is shown a fibre of mercerized cotton as seen under the microscope.



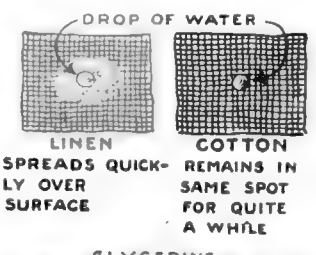


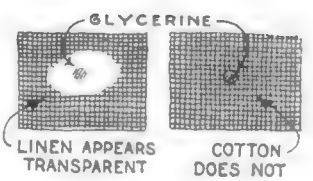
At the right "A" is a wool fibre "B" is worsted. The former is short, serrated, soft and fluffy, the latter is combed, having parallel smooth strands.

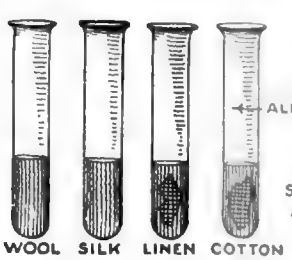


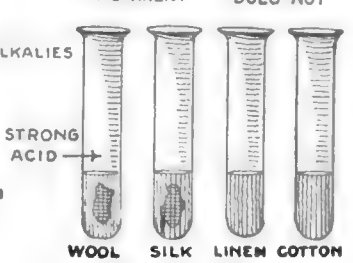


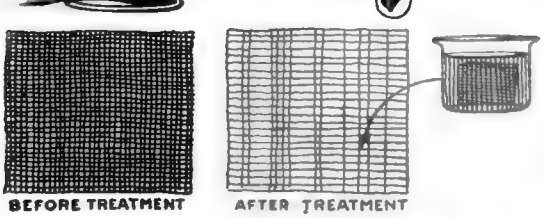
The water and glycerine tests for linen and cotton are well known. Wool or silk will be dissolved if the cloth containing them is treated with an alkali, such as caustic soda, while strong acid will destroy linen and cotton. The botton circle shows shoddy.



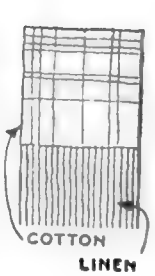


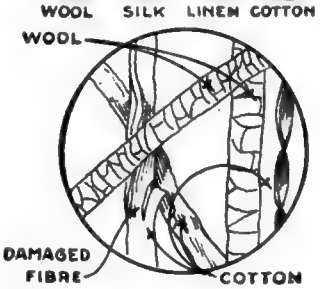






Linen and cotton burn with no odor. For testing a piece of wool cloth for cotton, boil it in a 5% solution of potash for fifteen minutes. The wool will be dissolved, leaving the cotton. For thin cloths, it is only necessary to hold a match to its edge. The cotton will burn quickly, while the wool burns slowly. Concentrated sulphuric acid will dissolve cotton quicker than linen.





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Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it in. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

A FOOLISH ARTICLE

Editor, *Science and Invention:*

In a scientific magazine I read the following concerning Deep Sea Salvaging. The article was called "Can Deep Sea Salvaging Be Made Safe?"

"Thump, thump, thump!" The leaden feet of the diver clump on the deck of the salvage steamer. Ninety pounds of the heavy metal weigh down his body. It looks weird to see him try to lift the burden by moving his legs. One has the impression that the deck is a magnet and that the metal weights are not lead but iron or steel, pulled down by the attracting force. He slips into a suit of rubber, an iron cask fits over his head, over the gunwale he goes, ropes and tubes alone connecting him with the vessel. Without so much as a wave of his hand, he slips down into a salty sea, a lone pioneer to face the many dangers of the deep. His shoulders bob slightly for an instant, then vanish and all at once the top of his helmet is gone, too, and only a ripple shows where he has sunk. The diver is on his way to inspect a sunken vessel. A tube through which is pumped oxygen, and cords which support his weight and give him telephonic communication to those above are the slender strands upon which he depends for life and for aid in case he is in need of succor——."

In another part of the same article,—"A break in his rubber suiting would drown him——."

And again,—"The diver works in about two and a half atmospheres of pressure. A sudden drop, though even for only a few feet, and nose bleed may result. A further drop might bring the iron helmet down tight about his head. Men have died from just such an accident as this——."

And further on we read—"After an hour's toil he is brought again to the surface. He must rise very slowly. His blood and tissues are overcharged with nitrogen, due to his being under air pressure. Should he return to normal atmospheric conditions too quickly he would fall victim to that terrible malady known as the 'bends,' or caisson sickness——."

And at last this—"It takes about four hours to safely permit him to come back to normal atmospheric pressure——."

Is there any truth in these statements?

J. B. Canton,
New York City.

(You have not given us the name of the publication in which the article on Deep Sea Diving appears. However, here are the facts!

The writer states that the diver was working in two and one-half atmospheres of pressure. He did not for one moment realize that two atmospheres are no more than 40 feet. He did not know that divers, without the aid of diving suits, have descended more than 50 feet. The increase in pressure is .43 lbs. per sq. in. per foot increase in depth.

The author starts out with the diver "thumping" on the deck of the vessel, and then talks of him slipping into his rubber suit. Absurd, he must put the suit on first before he "thumps." He states that an iron cask fits over his head; there is no such thing. The helmet is made of copper. He likewise states that a ripple shows where he has sunken. It is not a ripple, it is a stream of bubbles.

Likewise, oxygen is not pumped through the tube, but ordinary air. He also states that a break in the rubber suit would drown him. Absolutely ridiculous. A break in the suit anywhere below the waist-line will not have any effect whatsoever, and in many places above the breast plate the break would have no effect.

The diver's suit hugs him just as closely as wet clothes stick to a person's body. Should anything happen to him, the pressure would not drown him. He could bob up to the surface very rapidly, bounce up out of the water and finally come to rest unless he became entangled with the wreck.

It is absurd to state that a drop of one or two feet, or ten feet, in two atmospheres or even 2½ atmospheres would cause a nose bleed. It is further absurd to state that the "iron" helmet would be brought down tight over his head as the "iron" helmet has a shoulder plate attached to it which prevents such accident. The helmet rests on the shoulders. Neither does he have to rise slowly from two atmospheres as stated, inasmuch as when a diver goes down to a "great" depth, he can only stay there one minute, that being the practical maximum of the ordinary diver (bathing costume).

The diver's blood and tissues are not overcharged with nitrogen at any time when working under two atmospheres, and neither is it probable that he will suffer from the bends. The writer has seen children eight years old subjected to the same atmospheric pressure, namely, two or three atmospheres.

Then the author of the article states that this malady (the "bends") formerly afflicted men who had to work under atmospheric pressure never using the word abnormal. Don't let anyone tell you that it required four hours to permit a man to come back to normal pressure from a pressure of two atmospheres.

The whole article, wherever it may have been printed, must have been written by a writer of fiction who probably had read of divers, but never saw one. He is undoubtedly like the farmer who when he saw an airplane for the first time, exclaimed, "There ain't no such animal."—Editor.)

ANOTHER VICTIM

Editor, *Science and Invention:*

I have enjoyed your articles and pictures very much on crooked gambling, by Mr. Mark Mellen.

Here are two cards that I think must be marked. I lost a lot of money while this deck was used. I think they are marked, but I can't see how it is done.

You can see why I do not care to give my address, because I do not want the fellow to know I am on to him. But you could see if they are marked and you could publish them in your magazine showing the marks if any.

Thanking you for same in advance and repeating that I enjoy all the articles in your magazine, but especially those on gambling exposes.

A Regular Reader.

(Yes, your cards are marked. The markings are very well made, and are found in the flower parts of the back of the deck. Markings such as these are hard to discover. On the leaves in the upper left hand corner of the back of the card are red cross lines and straight lines indicating suits and value. We will be glad to give information of this nature to any of our readers desiring it. We respectfully request that they send us their name and address (which will be kept confidential) so that we may reply by mail directly instead of through the columns of this paper.—Editor.)

STUNG! !

Editor, *Science and Invention:*

Can you tell me through your columns if this deck of cards is right or wrong?

Think I've been a sucker.

Bank Clerk.

(You have been. The cards are "trick" (?) cards marked when printed. Such markings are difficult to read and discover. You will notice that the plaid backs differ with regard to the size of a particular white space which can only be pointed out. We need the complete deck to give you the code.—Editor.)

MARKED CARDS

Editor, *Science and Invention:*

Your article in the June number of SCIENCE AND INVENTION about the marked cards and coins is very good.

Can you tell me if this card is marked?

If it is I will only be learning what I suspect now, so I will not give my name.

If any cards were marked it would be the ace, wouldn't it? If this card is marked, how and where are the markings? You can publish it in your magazine, but do not say who this letter comes from.

A Chicago Reader.

(The Ace is often not marked, but the card you sent was marked in red ink along the printed border. The mark can be seen at a distance of ten feet. In sending suspected cards, try to send as many as possible.—Editor.)

BRICKBATS AND BOUQUETS

Since you wish to know what your subscribers think of SCIENCE AND INVENTION in its new form I hasten to give you my opinion. First, let me say that your theory that many only look at the pictures is correct; in my case at least. Your captions are so long that they are really condensed articles. Yet you must be careful that in seeking brevity you do not sacrifice clearness. Moreover, your captions so nearly fall into the category of short articles that the use of capitals and bold-face type, proper for short captions, seems forced and confusing. This confusion is further aggravated by the way you manhandle the captions to squeeze them into ill-shaped spaces.

On the whole, I am pleased with your new policy. But if you devote the magazine too largely to pictures, you will enable me to read it through too easily and thus give me the impression that it lacks "meat." If you retain your scientific fiction, jokes, regular departments (especially that of fiction and astronomy), and two or three other full-page articles, you will keep in your fold those of us who want to know that we have "got something." And let us hope that Mr. Chapin, who has been offering scientific puzzles, will not leave us.

With the sincerest of wishes for the success of the magazine.

F. H. Perrin,
West Medford, Mass.

QUESTIONING OUR POLICY

Editor, *Science and Invention:*

I note in your last month's edition you state there were no $1.00 or $2.00 prize entries and still my drawings were returned with a reason given (subject not likely to interest all readers). Probably what I mention here would interest the readers more.

There is a nigger in the wood pile and I believe I see him. What kind of a hand are you playing? Too bad some more of us were not born a Dr.— or a Prof.— so that we may have a chance for a prize in your so-called CONTEST in your magazine.

J. Kuhhorn,
New York City.

(It is not necessary to be either a doctor or a professor in order to win a prize in the contest conducted by SCIENCE AND INVENTION MAGAZINE. Inasmuch as you live in New York City, you can at any time come down to our offices and examine our records, and you will find that there are thousands of individuals in the United States who have won prizes, some of whom have not even had an ordinary public school education. The main idea is to get a popular practical suggestion, which would have a general appeal to our readers, and which is not copied from another magazine or book.

Some of the writers for our magazine are paid for on a contract basis. Their names are generally familiar. Except for special articles written by these authors, their subjects are not eligible for awards in the prize contest.

When mention is made that there are no contestants for the $1.00 or $2.00 prizes, we mean just that. Every article in the magazine has had a prize awarded it, and we award prizes for every article found suitable for publication, with the exceptions noted in the paragraph above.

If you care to check through the magazine, you will find there are quite a few authors whose names are not listed in the award column and who have received no prize. Those authors are not eligible for prizes by reason of previous contracts.

We will be pleased to entertain you should you care to drop in on us any Saturday morning before 1:00 o'clock, or any afternoon before 5:30. We are always busy, but never too busy to see any of our friends and give whatever council we can to our reporters who are doing such excellent work in the field.—Editor.)

WHY?

Editor, *Science and Invention:*

Why do we follow a system which works some of us until we are too exhausted to enjoy life, starves others; produces idiots, crazy people, cripples and criminals of every description; piles up wealth for a few, who are unable to find time to put their wealth to proper use; yet it makes slaves of them who believe every word they hear uttered in regard to investments and ways of gaining wealth?

Why let out produce waste in field and forest, also goods decay in store houses, becauses many people do not know how to gain and reserve money enough, to supply their needs?

Why not distribute the labor of the community in a co-operative manner, giving each individual duties in comparison to their age and strength; both old and young finding life interesting and their duties pleasant responsibilities?

Why not plant our produce where nature can bring it forth in perfection, be it grain, fruit, forests, or animal life?

Why not have a system of gathering and distributing all produce from one community to another, that will eliminate waste, poverty and starvation?

Why build such cumbersome cities, shutting out pure air and light?

(*Continued on page* 609)

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Disappearing Search-Lights

WARFARE and the coast defense are dependent to a greater extent than is generally supposed upon light—artificial light. Knowing this, engineers of the U. S. Army closely connected with coast artillery and other branches of the service where searchlights are imperative, have just developed the new method of mounting them shown in the above illustration. The light itself is mounted atop a swinging tower which may be lowered or raised by one man. Thus advantage is taken of the natural camouflage of brush and small hills where the light is installed. The ease of operation of the device is gained through a system of elaborate braking mechanisms.

The above photograph shows the tower with its light being raised to position. The height of the tower allows the beam from the lgiht to pass over high intermediate obstacles. —George F. Paul.

Mercury's Creviced Landscape

Upon the basis of wide and accurate observations of Mercury made by the late Prof. Lowell we give herewith an artist's conception of the surface of the planet. It is a burned out world like the Moon. Note the huge cracks radiating from centers for hundreds of miles in all directions. Also the craters.

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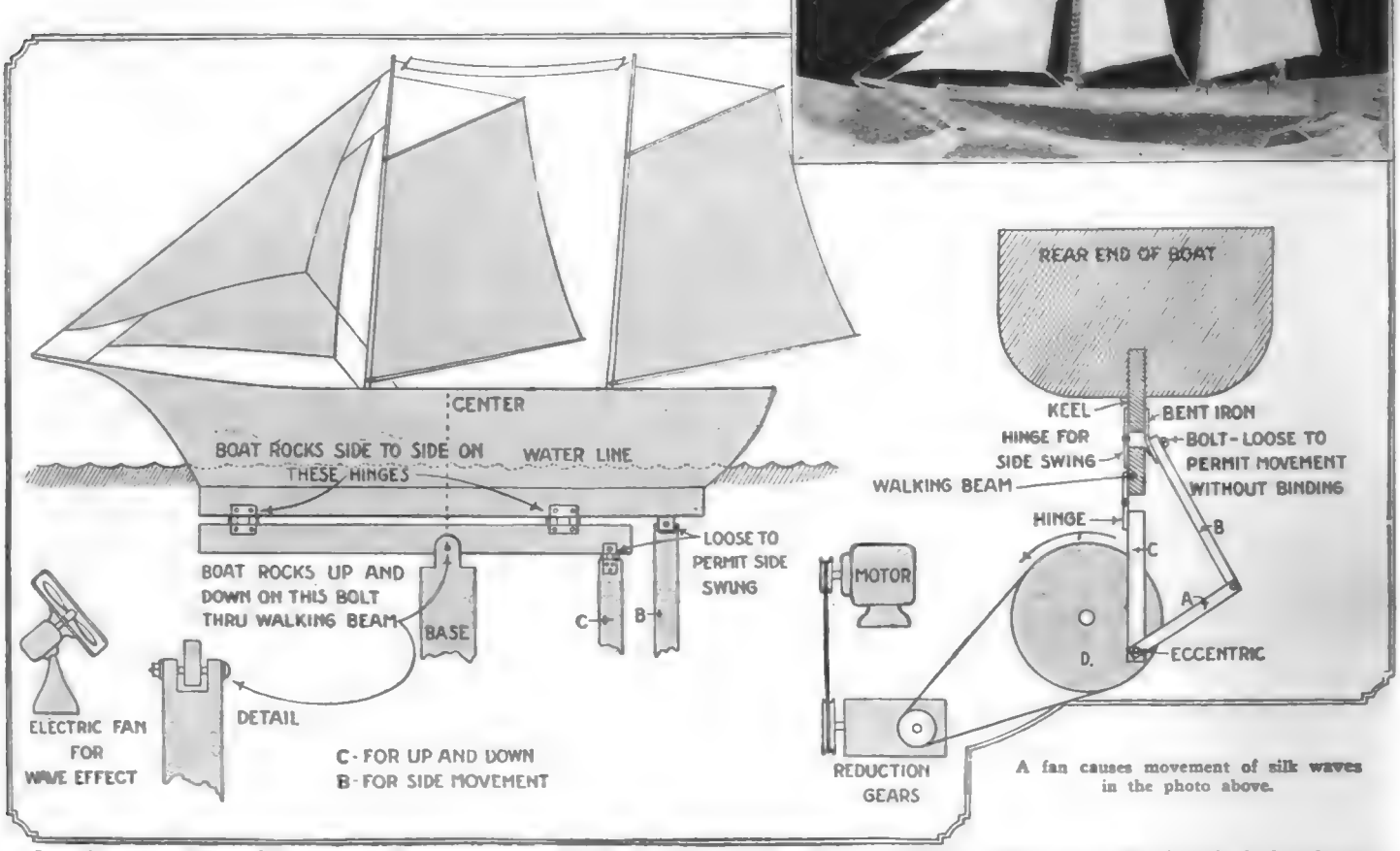
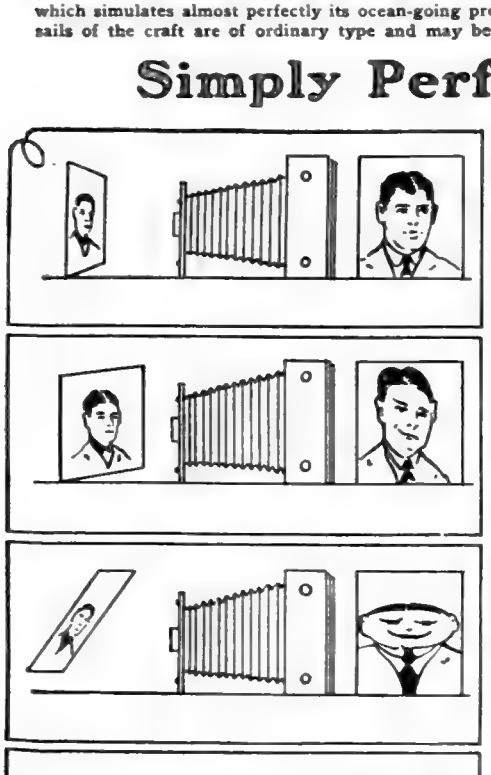
Rocking Ship Window Display



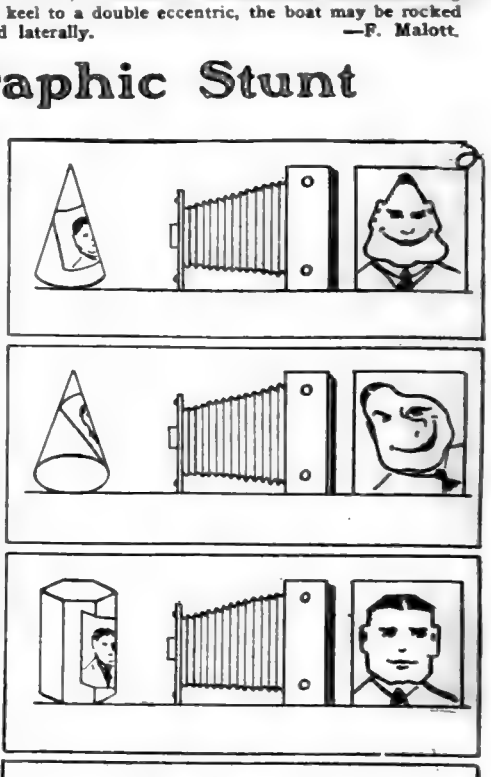
A fan causes movement of silk waves in the photo above.

One of the most novel of recent devices used to call the attention of passers-by to window displays or other advertising is the rocking ship, which simulates almost perfectly its ocean-going prototype. The body and sails of the craft are of ordinary type and may be built to represent any craft desired. By using the walking beam hinged to the keel, and supporting the beam on a rocker, as shown in the sketches, and connecting both the beam and the keel to a double eccentric, the boat may be rocked both longitudinally and laterally. —F. Malott.

Simply Performed Photographic Stunt



With an ordinary copying camera, advantage may be taken of certain photographic laws and exceedingly humorous photographs will result. Any number of effects may be obtained, and the few shown on this page illustrate simply the primary processes. If the photograph to be copied is set in a position at an angle with the plate upon which it is being copied, foreshortening of some part of the image will result. If the subject is rolled around a cylinder, or placed upon a cone or hexagon, still different reproductions occur. In the last sketch the plate being developed is taken from the fixing bath wet, a match is held under the image, and the gelatine allowed to run.—S. H. Samuels.



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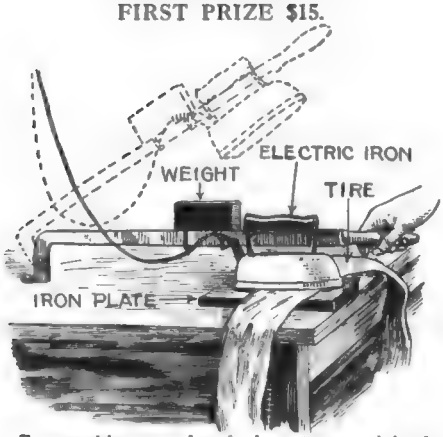
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.

The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Vulcanizer

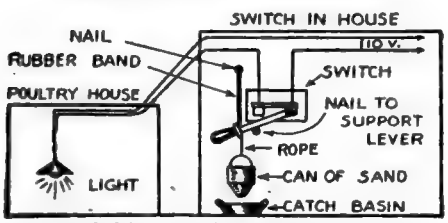
FIRST PRIZE $15.



By attaching an electric iron to a weighted arm, as shown above, and fixing an iron plate beneath it, a vulcanizer results.

—W. B. Matthews.

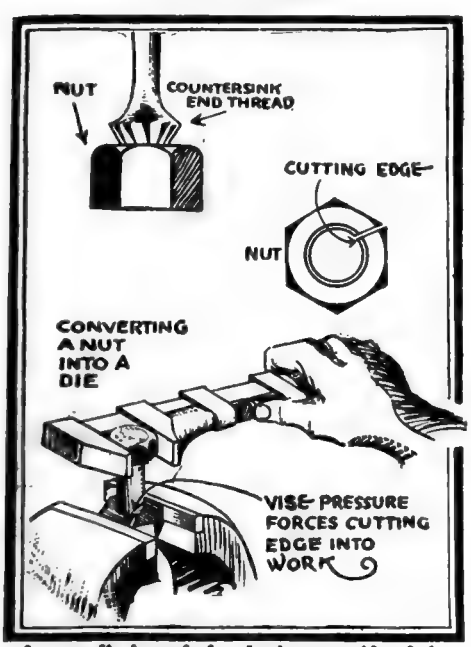
Electric Feeder



The sand drips out of the bucket attached to the switch just at the right time to allow the rubber band to close the switch, lighting the light or actuating a feeder in the poultry house.

—J. Stevenhagen.

Nut Die

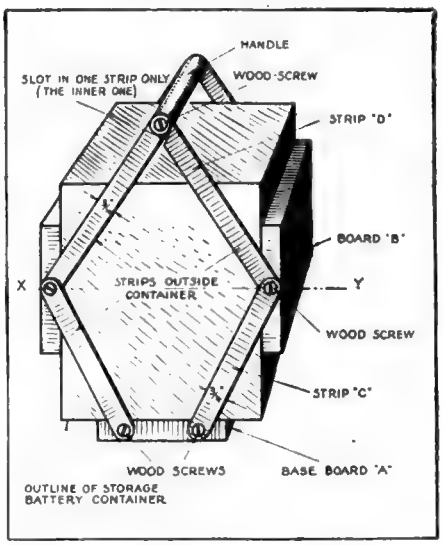


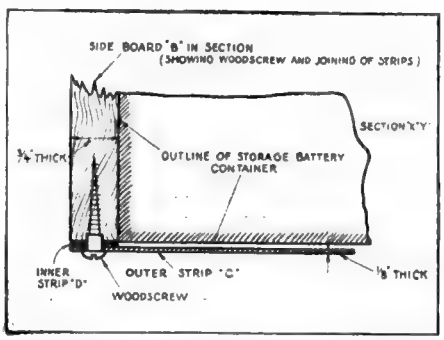
A nut die is made by slotting one side of the nut, counter-sinking it at one end and holding it in a vise, as shown.

—G. A. Luers.

Storage Battery Carrier

SECOND PRIZE $10

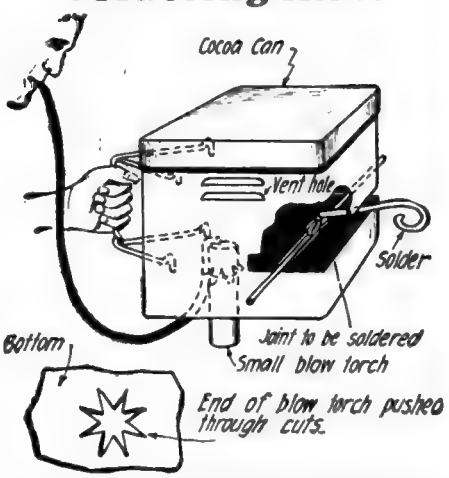




A few pieces of board, some thin iron strips and a piece of broom stick make a carrier for storage batteries.

—C. A. Oldroyd, Reporter No. 4433.

Soldering Kink

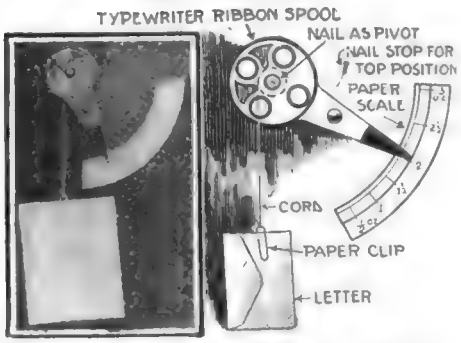


The cocoa can with handle and slit inside acts as a shield for doing out-door soldering work in the wind.

—Paul F. Bryant.

Postage Scales

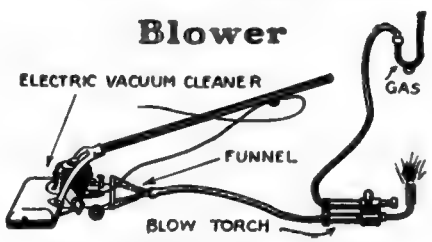
THIRD PRIZE $5



To an old typewriter ribbon wheel a weighted arm is attached, which passes over a scale, as shown. The string around the center of the spool attaches to the letter to be weighed.

—C. A. Oldroyd, Reporter No. 4433.

Blower



A blow torch using illuminating gas may be provided with air at pressure by using the back draught of a vacuum cleaner, as shown above.

—Alvin W. Hass.

Heater

Two joints and two elbows of stove pipe and a two burner oil stove combined as above form an efficient heater.

—Wm. L. Rankel.

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WRINKLES
RECIPES & FORMULAS

Edited by S. GERNSBACK

Handy Holder

When replacing small screws in a clock or watch, if a strip of paper is used in which the screw is placed, the latter can be very readily replaced without loss of time.

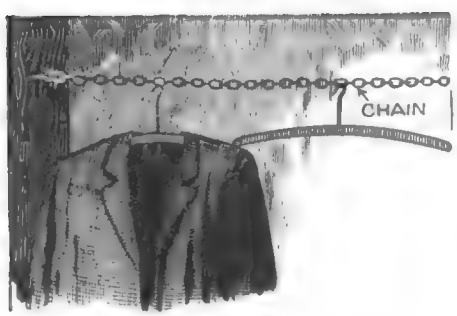
—Gus Oline.

Celluloid Cement

Broken celluloid jars can be mended by the following simple treatment. The surface is first cleaned by scraping and undiluted glacial acetic acid is applied with a fountain pen filler. After a minute or two, the ends of the fracture are pressed firmly together and left under pressure.

—G. Eric Jones.

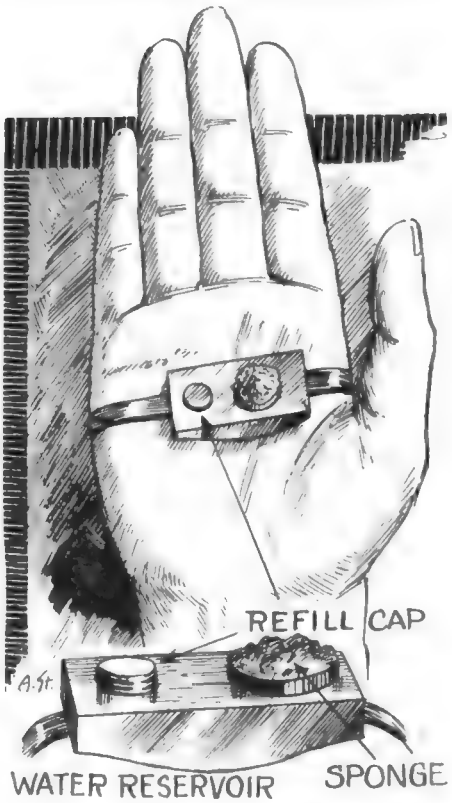
Clothes Hanger



A very much better method of suspending clothes hangers is by the use of a length of chain stretched between the walls of the closet.

—Clifton Ask.

Speedy Moistener



A very efficient finger moistener that fits in the palm is made from a piece of sponge or felt placed in a small water reservoir. This is attached to a small strap and finds itself readily available for immediate use.

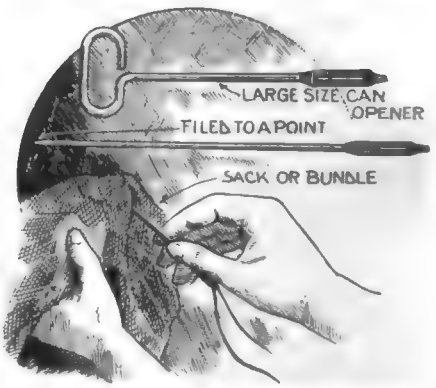
—Martin Boris Beline.

Stopper Remover

Obstinate stoppers can be removed quite easily by winding a few turns of copper wire around the neck of the bottle and heating the end in the flame of a bunsen burner.

—J. Schwarz.

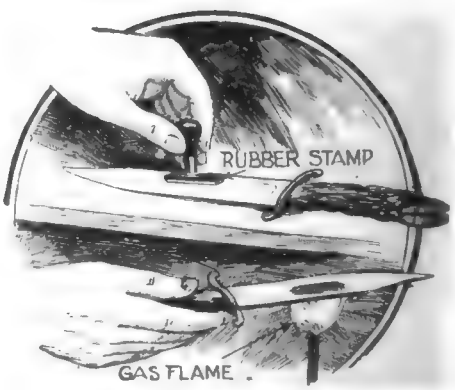
Novel Needle



A large size can opener filed to a point makes a useful needle for sewing up sacks.

—Fred Ayres.

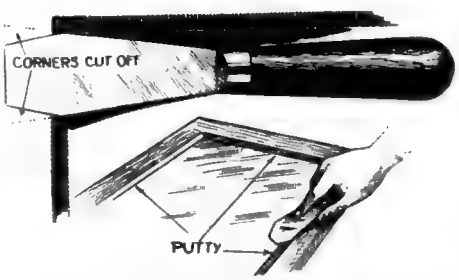
Etching Steel



For successfully etching swords and knives, the following procedure is prescribed: Procure rubber stamp of name to be etched. Dissolve one quarter ounce shellac in one quart of alcohol and two ounces of dragon's blood in the same solution, filter. Use engraver's etching ink and stamp blade. Powder with dragon's blood and heat gently. Dip blade in solution made above and heat until enamel bakes evenly. Saturate piece of cotton with gasoline and rub over inked part. Suspend blade in a 40% solution of perchloride of iron and etch until desired depth is obtained. Lye is used to clean off the enamel.

—Frank J. McCarthy.

Putty Knife



An improved putty knife can be made by cutting an ordinary putty knife as is shown in the diagram.

—Stanley P. Head.

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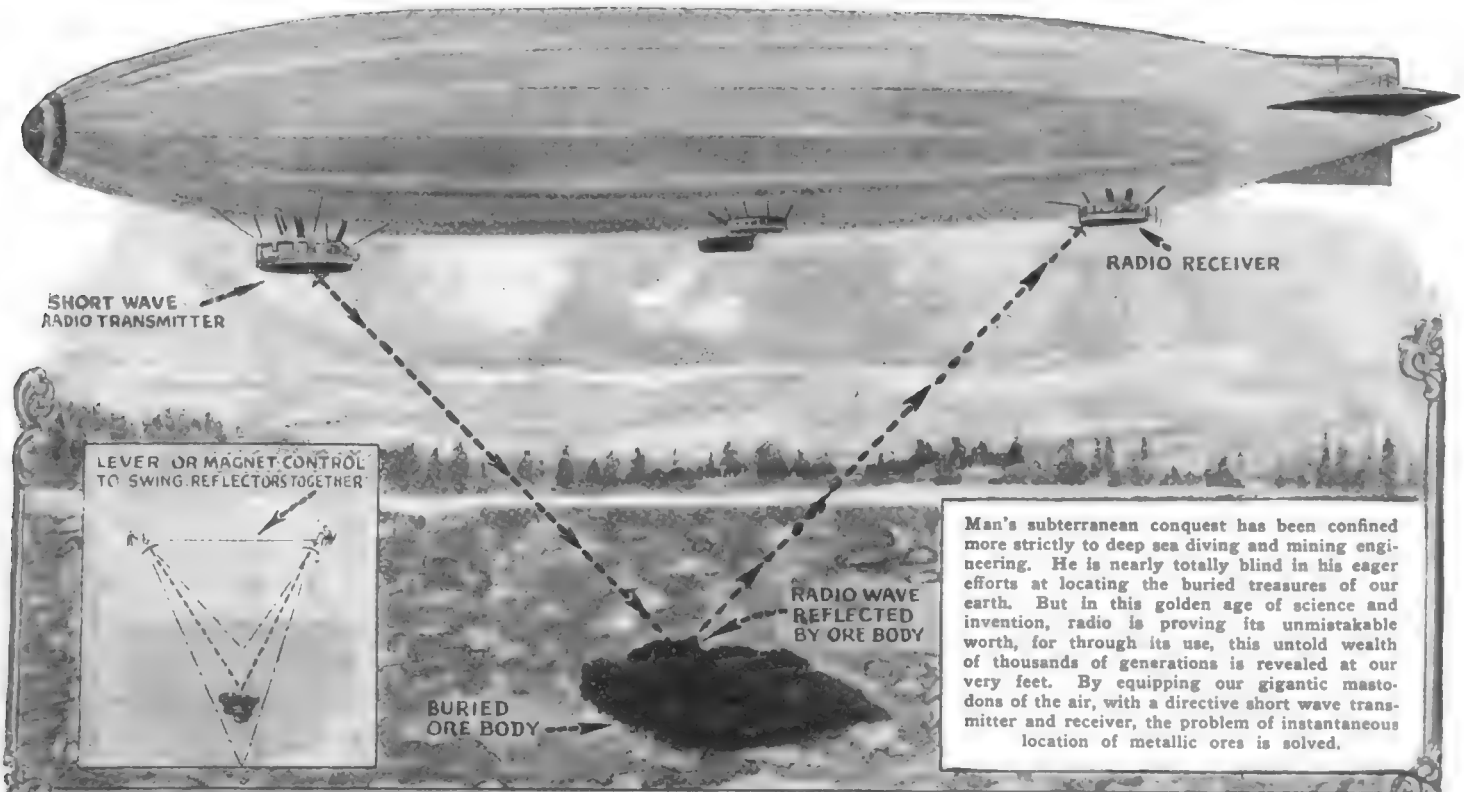
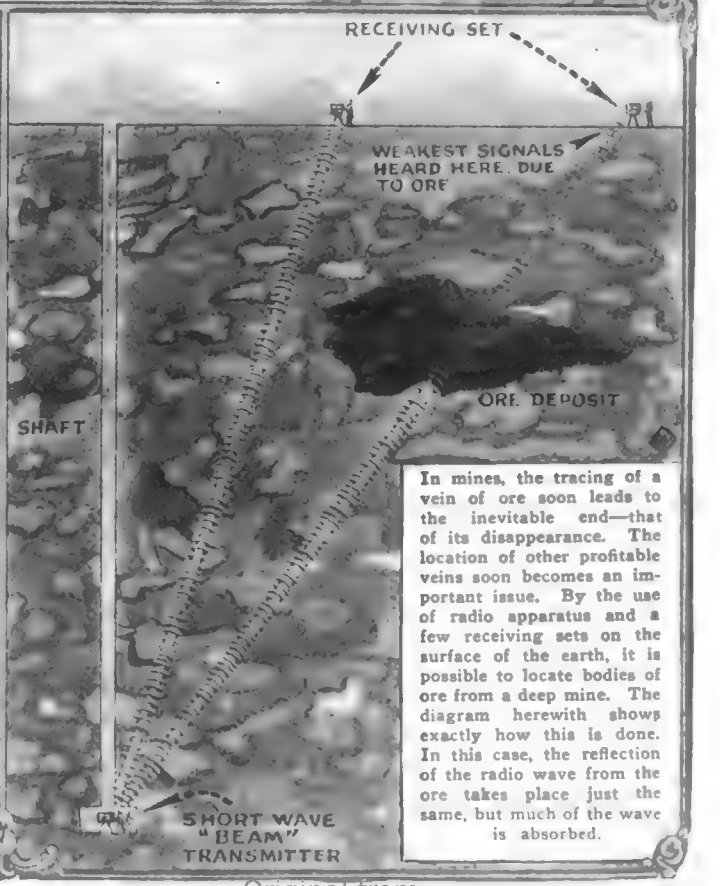
RADIO

Detecting Ore by Radio


SHORT WAVE RADIO TRANSMITTER
RADIO RECEIVER
LEVER OR MAGNET CONTROL TO SWING REFLECTORS TOGETHER
RADIO WAVE REFLECTED BY ORE BODY
BURIED ORE BODY

Man's subterranean conquest has been confined more strictly to deep sea diving and mining engineering. He is nearly totally blind in his eager efforts at locating the buried treasures of our earth. But in this golden age of science and invention, radio is proving its unmistakable worth, for through its use, this untold wealth of thousands of generations is revealed at our very feet. By equipping our gigantic mastodons of the air, with a directive short wave transmitter and receiver, the problem of instantaneous location of metallic ores is solved.

Ore detection by radio which has already given promising results in many cases, is the process of using a sulphide ore body as a transmitting antenna to which is coupled a short wave transmitting apparatus. The prospector goes about with receiving sets and notes the strength or weakness of the signals which are received at various points concentrically about the ore body. He is thus able to deduce the size and shape of the sulphide ore which he is using as his transmitting antenna. The ore is first located by the use of a radio set from an airplane.



In mines, the tracing of a vein of ore soon leads to the inevitable end—that of its disappearance. The location of other profitable veins soon becomes an important issue. By the use of radio apparatus and a few receiving sets on the surface of the earth, it is possible to locate bodies of ore from a deep mine. The diagram herewith shows exactly how this is done. In this case, the reflection of the radio wave from the ore takes place just the same, but much of the wave is absorbed.

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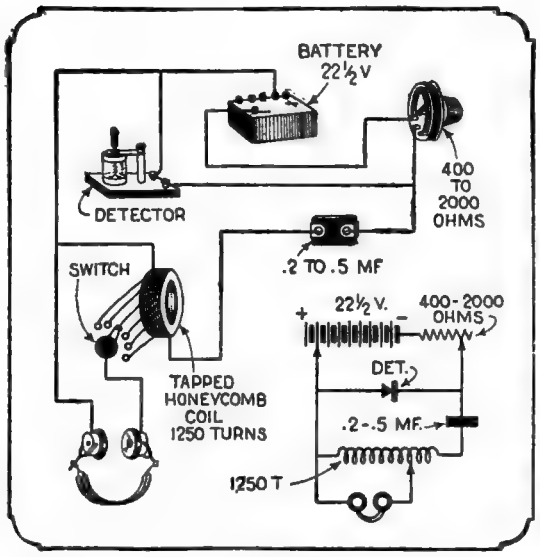
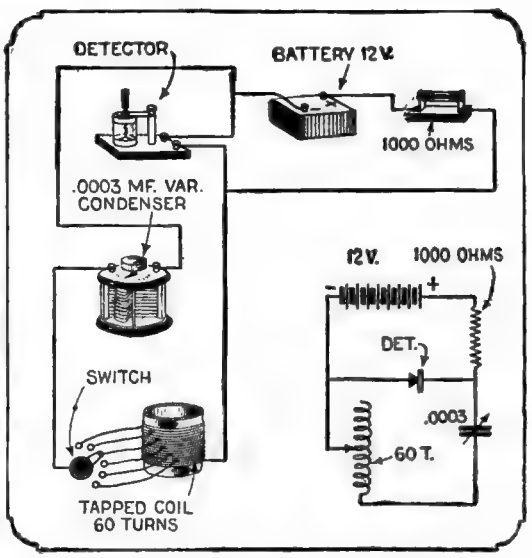
The Crystodyne

The Oscillating Crystal—A New Line of Interesting Research

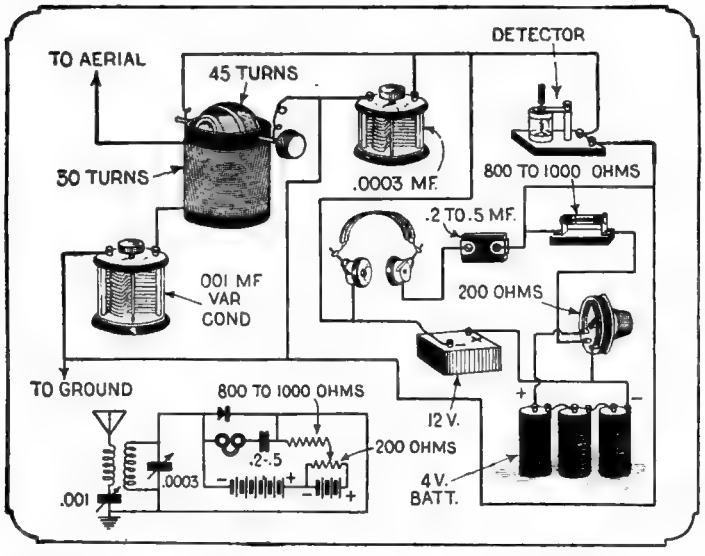


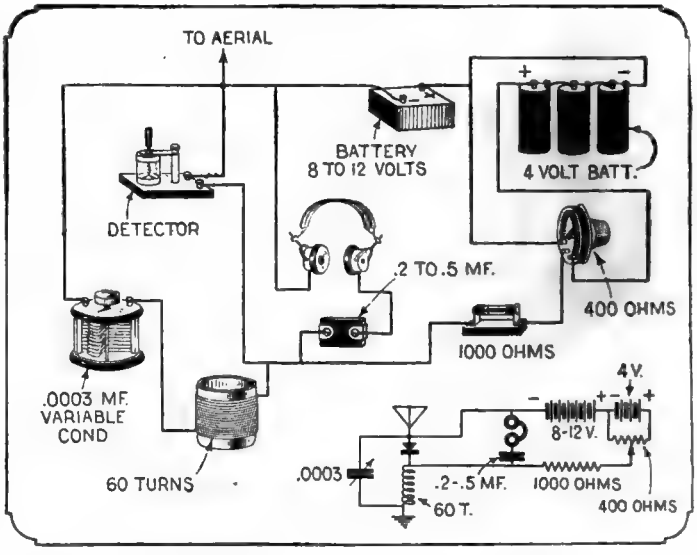
In the above diagram is shown an audio frequency oscillator using a crystal detector as the oscillator. Heretofore success was not attained using a crystal for the reason that the correct line of procedure was not followed out. It is now possible to obtain oscillations of a constant amplitude similar to those produced by the audion, the arc, or the high frequency alternator.

Imagine an ordinary crystal performing the many functions of our indispensible vacuum tubes! Yet this is a possibility. The crystal is now made to amplify and oscillate, besides detect. In other words, it is now doing what was thought impossible.

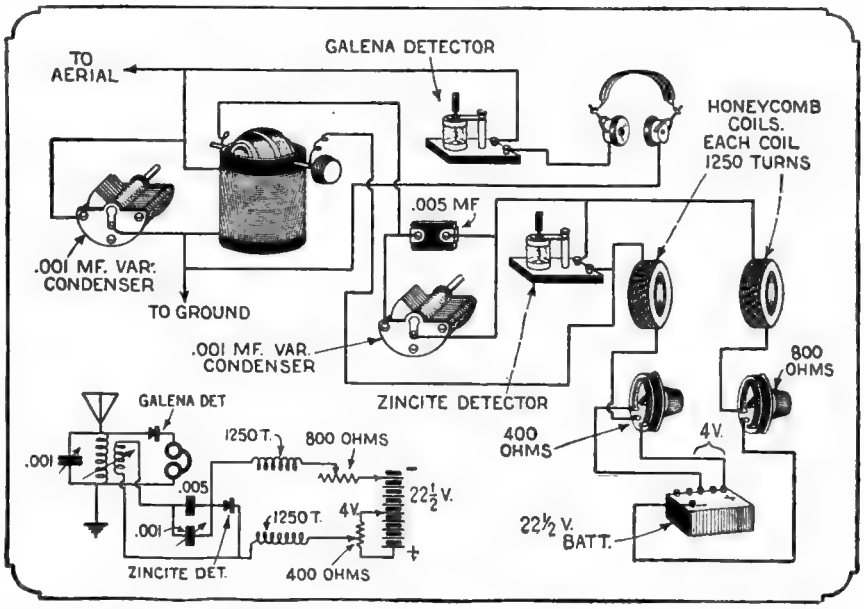


Not only will the crystal produce oscillations of an audible frequency, but can readily produce those of radio frequency. Every crystal will not oscillate, no matter what is done to it. Zincite especially, when fused with manganese dioxide has been found to give very best results. To find out whether the crystal is oscillating at radio frequency, a tube heterodyne is used.





The reception of continuous waves on a crystal detector is now a possibility. With the circuits given herewith it has been found that a wave-length as low as 25 meters can be reached. This only goes to show the large oscillating range of the crystal. Perhaps a more efficient method in the reception of C. W. signals is that depicted by the circuit shown on the right. A radio frequency is generated by the oscillating crystal, while an ordinary galena rectifies the incoming wave. In this way the incoming signal is heterodyned and maximum signal strength is the result. The main difficulty in the reception of signals is that of keeping the steel contact on a sensitive spot, as a slight jar will knock the crystal out of adjustment.



The above diagram shows the simplest circuit for receiving continuous wave telegraphy. A ground connection should be made between the inductance coil and the variable condenser. An inductively coupled circuit is more selective and can be seen in the diagram in the upper left. The possibility of having the oscillating crystal compete with the 3-element tube is rather slight, since the fact remains that it is a rather unstable device. As an experiment the reception of CW is decidedly interesting. Where the popularity of the oscillating crystal lies is undoubtedly in its properties as an audio frequency oscillator. Its intrinsic value in competition with the audion remains to be seen.

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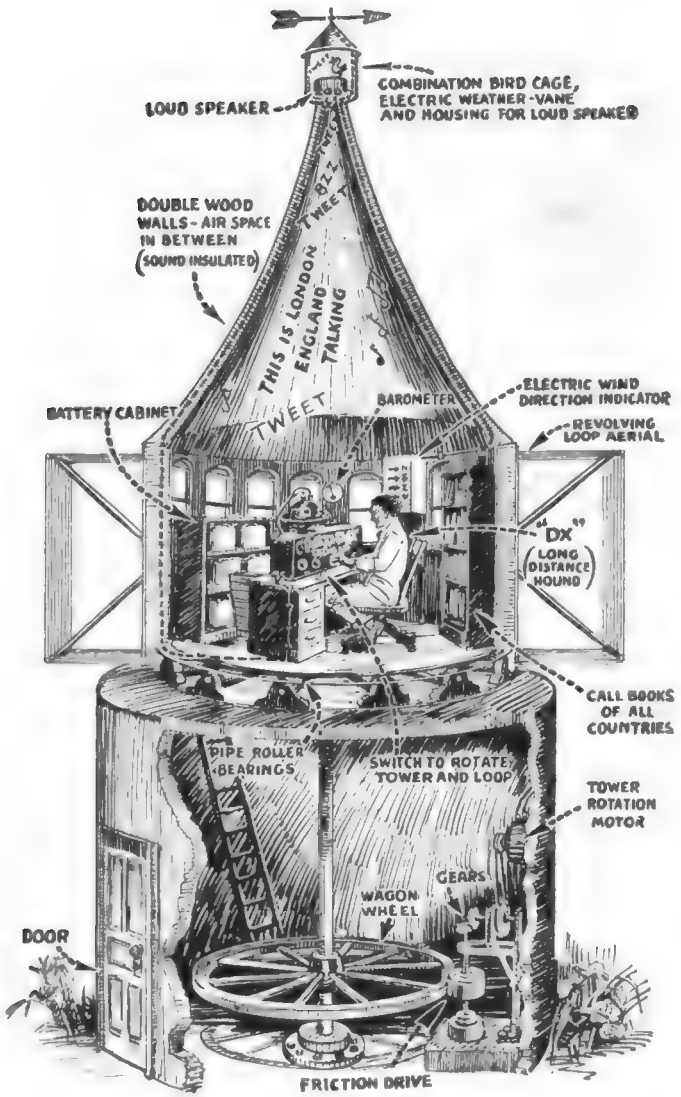
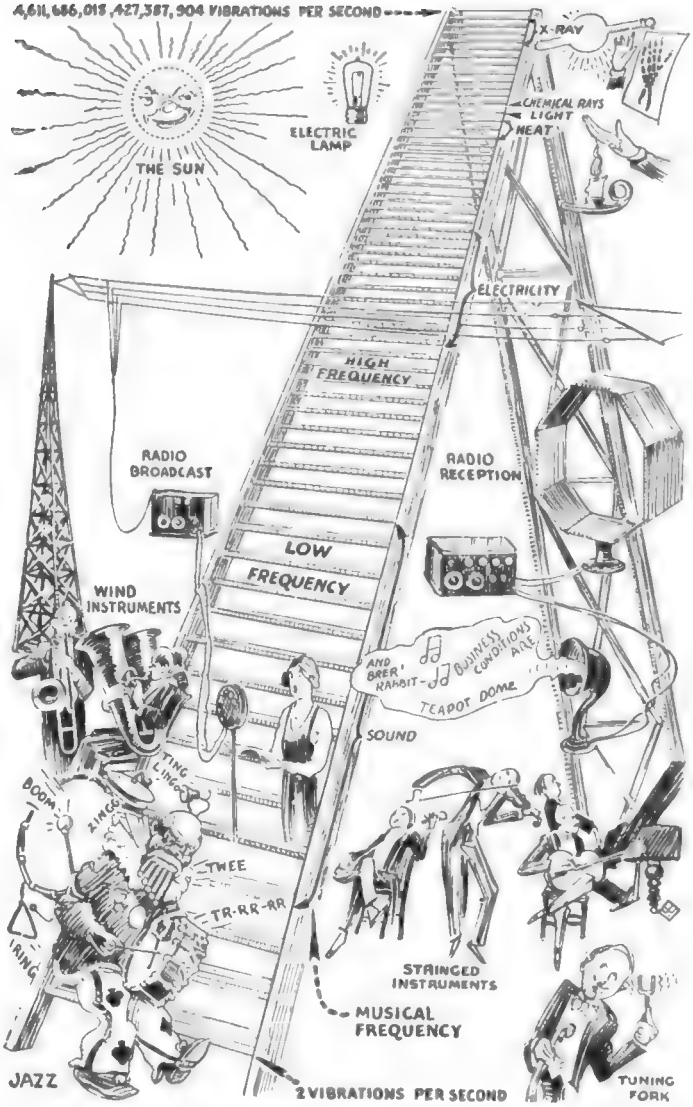
A Fan's Paradise



If a radio fan could build a radio receiving station to suit his own ideas, he would probably follow the above suggestions. The entire operating room may be revolved. This also revolves the loop aerial. Note the complete scientific and radio equipment as well as the built-in loud speaker. —W. E. Mayer.

Ladder of Vibrations



Each step of the ladder representing the table of vibrations indicates an octave. There are 62 octaves, the vibrations doubling for each step or octave. The actual figures of the first and last octave are shown. For the intermediate figures the reader is referred to the Oracle columns of the May, 1924, issue of SCIENCE AND INVENTION.

Complete Data on Radio Tubes

Different Types of Radio Tubes	*Use*	*"A" Filament Terminal Voltage*	*"A" Filament Current in Amperes*	*Resistance of Rheostat in Ohms*	*"B" Plate Voltage*		*"C" Battery, Volts*
					Detector	*Amplifier*	
UV-201-A	Detector or Amplifier	5	.25	15	48	48—96	0 to 6 Volts
C-301-A	Detector or Amplifier	5	.25	15	48	48—96	0 to 6 Volts
UV-201	Amplifier	5	1	6		48—96	0 to 4 Volts
C-301	Amplifier	5	1	6		48—96	0 to 4 Volts
UV-200	Detector	5	1	6	18–24		
C-300	Detector	5	1	6	18–24		
Sodion D-1	Detector	5	.25	15	24		
UV-199*	Detector or Amplifier	3	.06	30	40	48—80	0 to 6 Volts
C-299*	Detector or Amplifier	3	.06	30	40	48—80	0 to 6 Volts
WD-11	Detector or Amplifier	1.1	.25	6	40–48	48—72	0 to 4 Volts
WD-12	Detector or Amplifier	1.1	.25	6	40–48	48—72	0 to 4 Volts
DV-6-A	Detector or Amplifier	2.7	.30	6	24–48	48—200	0 to 6 Volts
216-A	Amplifier	6	1.35	10		96—120	6 to 10 Volts

* To use these tubes on a 6 volt battery, use a 60 to 120 ohm rheostat.

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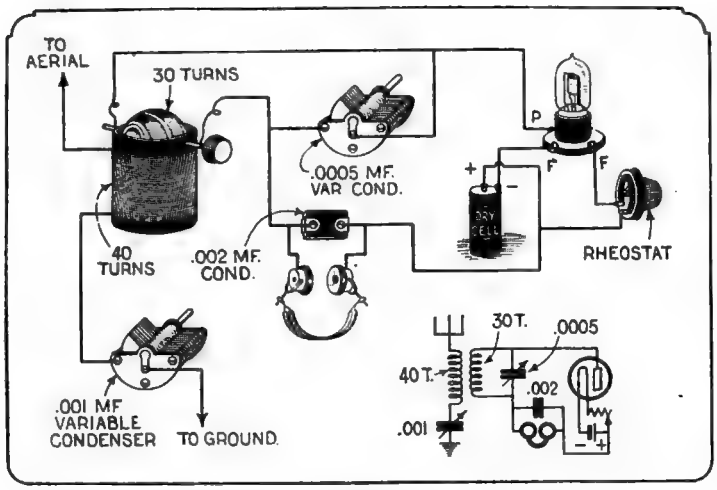
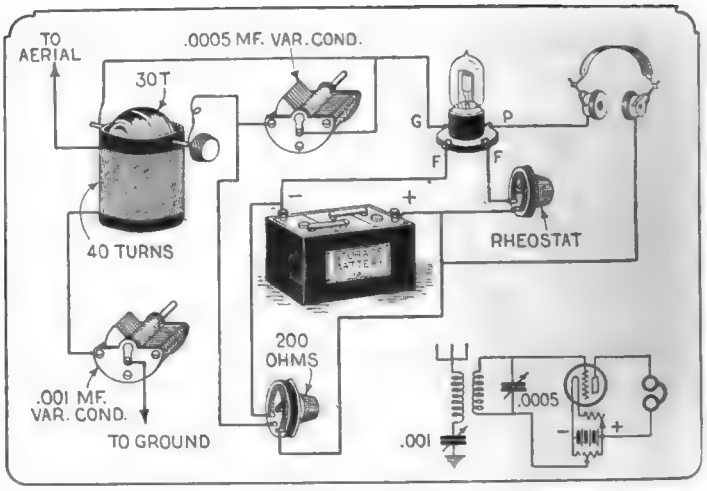
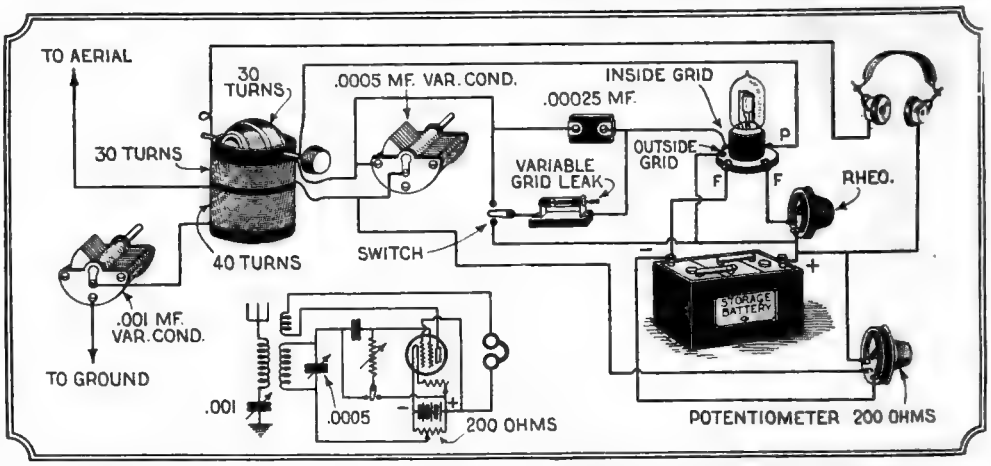
The Solodyne

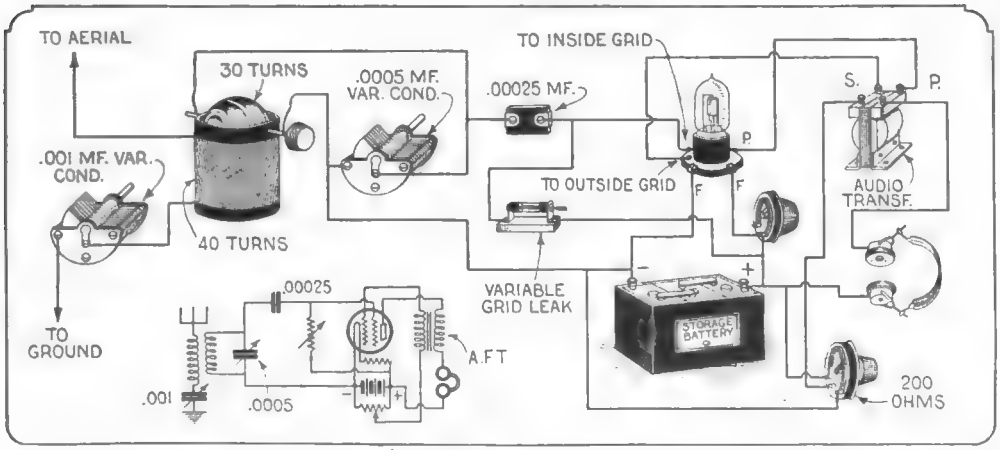
Circuits Which Eliminate "B" Batteries





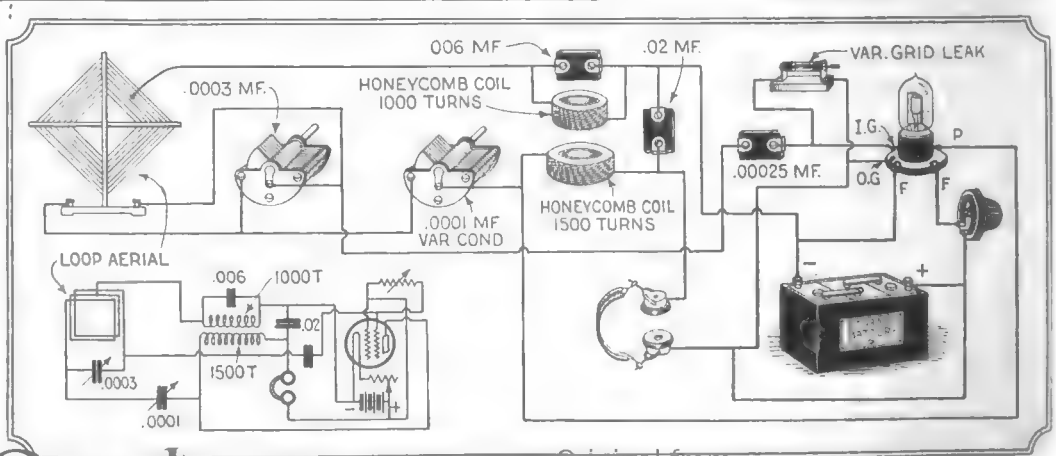
It all started when Thomas A. Edison announced the "Edison Effect"—the electronic migration from a heated filament to a cold plate. Fleming a short while later, applying this new principle evolved the now famous Fleming Valve. It was possible to receive intelligible radio signals with but one battery and be assured of more reliable communication than the crystal had afforded, and this, without the use of a "B" battery. Then came DeForest with his indispensable three element tube. Now comes a new development that vastly improves radio reception without the use of "B" batteries and incorporates a four element tube—the Solodyne. "What are its main advantages?" one may casually ask. By the elimination of the "B" battery, the burning-out of the filament of a tube becomes a thing of the past. Expensive transformers, phones, and fixed condensers are saved from the rather deleterious effects of burn-outs and blow-outs. Noise is practically done away with and reception is much more distinct.





The theory of the circuit is best explained by referring to the above diagram. The antenna circuit is roughly tuned to the incoming oscillations, which are induced in the secondary circuit where the tuning is sharper. Now due to the electronic emission from the hot filament, there exists a small direct current in the plate circuit. The inner-grid,—the tube having two grids, one inside the other,—and the plate are both positively charged, being connected to the positive side of the "A" battery. The circuit is made regenerative by coupling the plate to the secondary in the usual manner. The fact that the inner-grid is made positive, reduces the internal resistance of the tube by acting in the manner of drawing more electrons away from the filament,—the heavier the flow of electrons, the greater the conductivity. At the same time, due to the feed-back action, this same grid has imposed upon it relatively high potential values and thus, incoming signals are produced with more volume.

The Solodyne requires the use of hard tubes, that is, tubes having a high degree of vacuum for the reason that the gases inside a soft tube, when hot, become ionized and spoil the action. The fact remains that all radio circuits would work much better if hard tubes were used entirely throughout, since many noises are the direct result from the internal reaction going on. Experimentation with these hook-ups prove that the Solodyne is the only reproducer of pure musical notes. Distortion is unknown and while signal strength is not as great as with circuits using "B" batteries, the increase in clarity more than offsets this. The diagram above shows a feed-back hook-up, using but one four-element tube, while that at the right, shows a form of super-regenerative receiver using a loop antenna which is tapped at the center. The Solodyne is a step in the right direction for musical quality.



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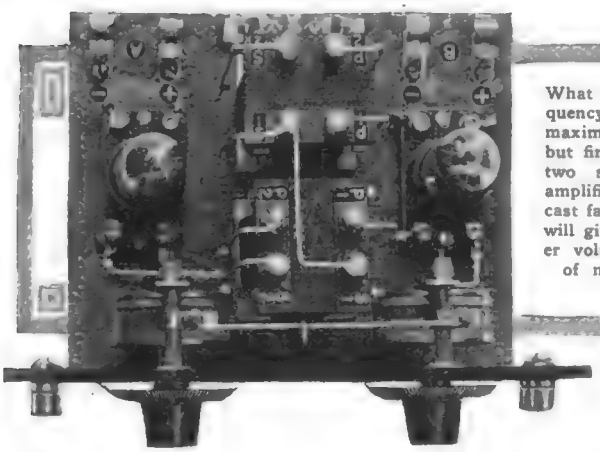
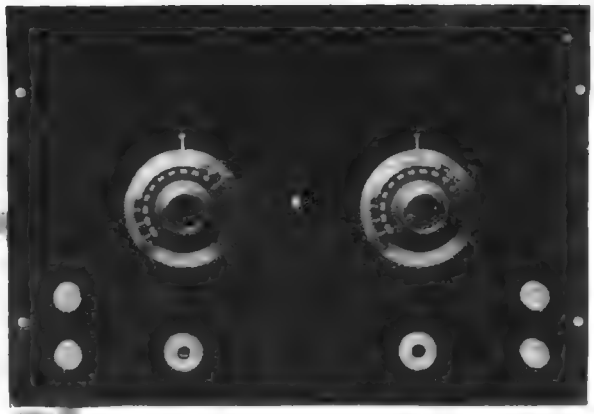
UV-199 Audio Frequency Amplifier

By KENNETH M. SWEZEY

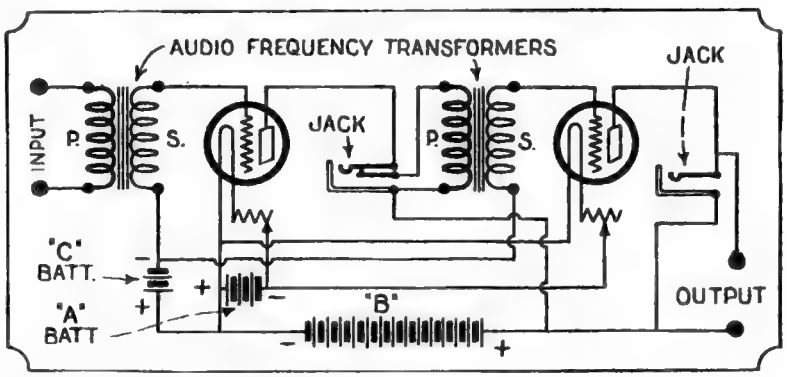


What is desired in audio frequency amplifiers is not a maximum of signal strength, but fine tonal quality. This two step audio frequency amplifier which any broadcast fan can easily construct, will give amplification speaker volume with a minimum of noise and distortion.



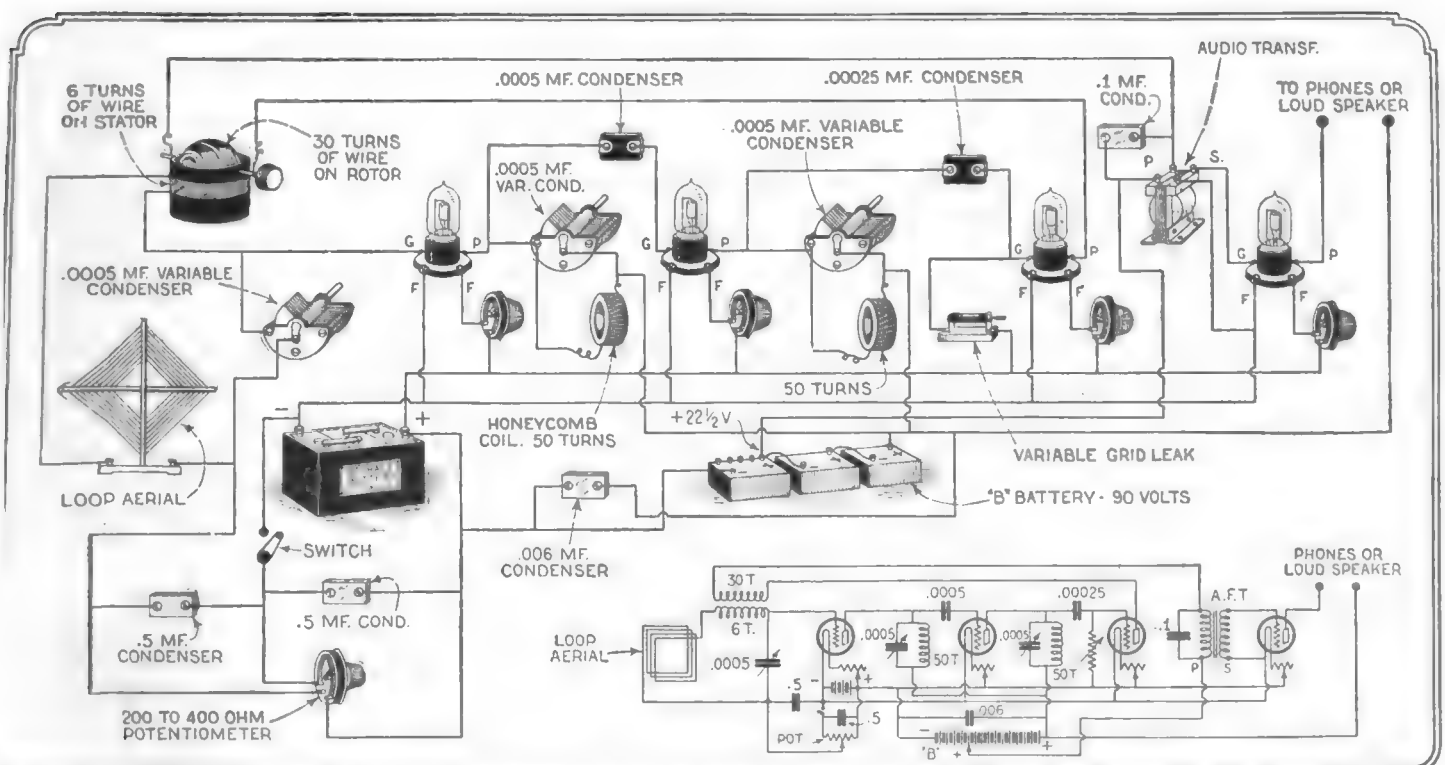
Note the clean cut appearance of the amplifier unit. Simplicity and care were the keynotes in its construction. It is the happy medium between a high ratio transformer coupled amplifier and a resistance coupled amplifier. Primarily, it embodies qualities which are inherent in both, to a certain extent. No by-pass condensers or resistance leaks are used because they are not necessary with UV-199 tubes.

The diagram on the right shows materials required. Besides two low-ratio A.F. transformers, there are used two 30 ohm rheostats, two UV-199 sockets, two jacks, four binding posts, six clips, a 7 x 10 x 3/16 inch bakelite or hard rubber panel, two 2-inch dials, a hardwood sub-base, ½ x 6 x 7¼ inches, and the necessary bus bar and spaghetti for connections. The layout of the parts and panel is obvious from the photographs. Much of the wiring is led through holes in the sub-base and distributed underneath. The transformers have their cores at right angles to each other. All battery connections are terminated in the Fahnstock clips on the baseboard and this facilitates easy connections. A provision is made for the "C" battery which will vary, usually, between 3 and 7 volts. Ninety volts are used as the "B" battery supply for the two tubes.



A "DX" LOOP RECEIVER

By HAROLD JOLLIFFE



The circuit shown here is one that has proved its utility after four months of experimentation. It consists of two stages of tuned radio frequency amplification, detector, and one stage of audio frequency amplification. Impedance coupling with a loop aerial is used, and although not a recent innovation, will probably be new to many experimenters. It may not be well known, but tuned impedance circuits are vastly superior to those using transformer coupling. This can be readily understood from the fact that the impedance coils may be tuned exactly to the frequency of the signal in the grid circuits. The tubes of the radio frequency amplifier have a pronounced tendency to oscillate when the impedance coils are in resonance, but the stabilizer in the form of a potentiometer will be found to be very effective in controlling the set. In the mounting of the impedance coils, place them either at right-angles to each other or else place a rounded metal shield between them.

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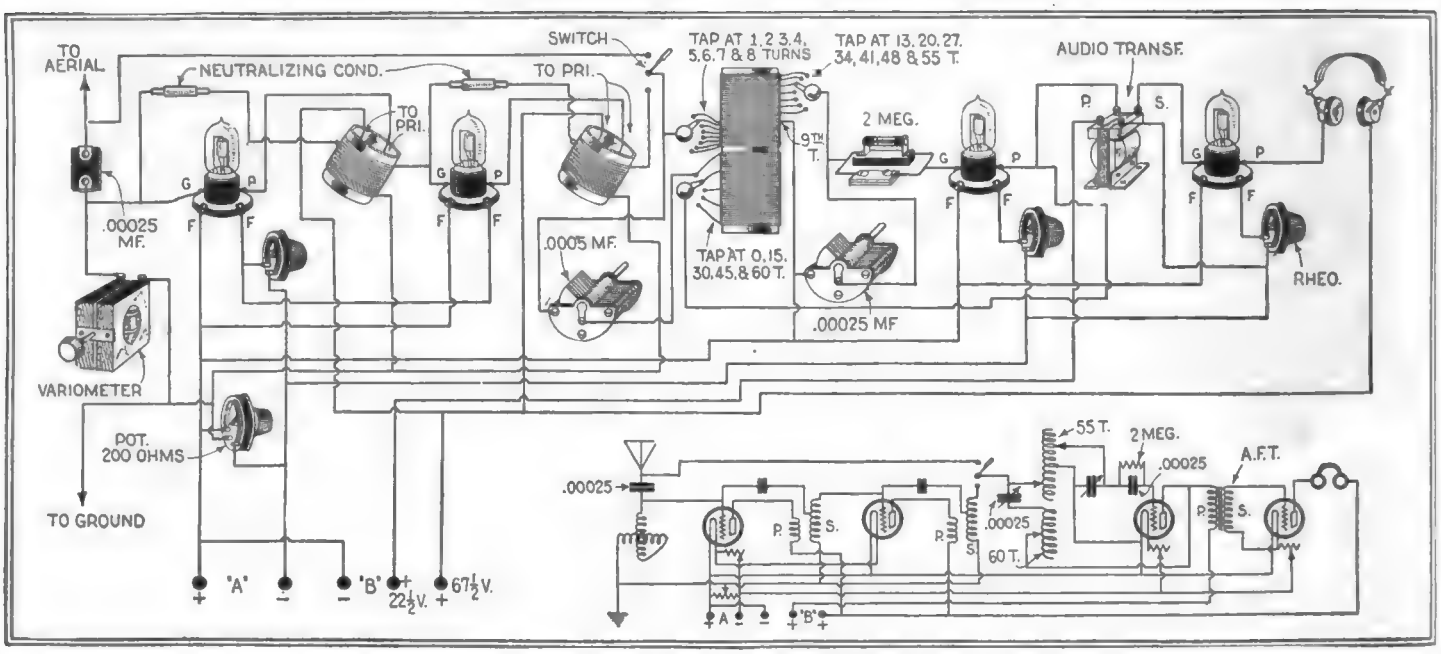
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.



(Q 296) As is well known, the Reinartz circuit is one of the most efficient regenerative circuits in use. The problem of adding neutralized radio frequency amplification to it has been met with fair success. This receiver will do remarkable long distance reception, but as a foreword, is very hard to control.

REINARTZ RADIO FREQUENCY

(296) Robert Hayden, Trenton, Mo., asks:

Q. 1. Kindly give me a diagram of a Reinartz circuit employing two stages of neutralized radio frequency amplification and one stage of audio frequency together with a list of all the necessary parts, and their values.

A. 1. The diagram you request is shown herewith.

BATTERY TROUBLE

(297) Chas. Weaver, Johnson City, N. Y., asks:

Q. 1. How may I test my set to find out whether or not the "B" battery circuit is correct, so that I will not burn out a tube?

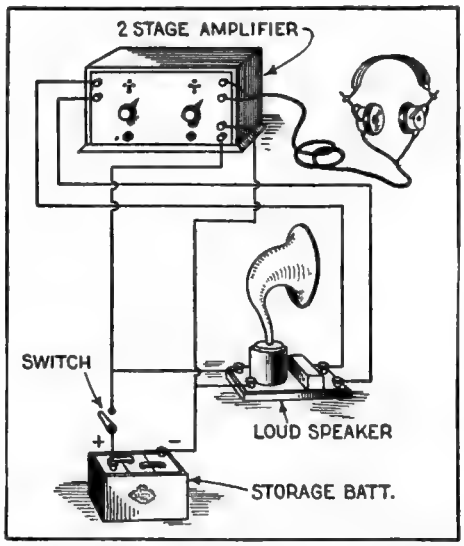
A. 1. The best method to use for the work you mention is to trace out your "B" battery circuit carefully and to make sure that it is not shorted across the filament. Another method is to connect up everything, including your "A" battery, but without the tube in the socket. Place a volt meter across the filament binding posts on the socket and note the reading. If it is higher than the reading of the "A" battery, then you may be sure that something is wrong and your circuit must be rechecked.

LOOP QUERY

(298) Roger Pryor, Union Hill, New Jersey, asks:

Q. 1. How can I make a loop to give me the best results on my Neutrodyne set?

A. 1. Twelve turns of No. 18 ordinary cotton covered paraffined bell wire, wound on a frame 3 feet square will answer. The turns should be spaced at least ¼ of an inch apart, and the loop when shunted with a .0005 variable condenser will cover between 200 and 600 meters very efficiently.



(Q. 299) A moveable Coil Loud Speaker lends itself very readily as a sensitive microphone and can be used to detect faint sounds many feet away.

DETECTAFONE

(299) Leonard Botwinick, Pasadena, Calif., asks:

Q. 1. Can you show me how to hook up a Magnavox loud speaker as a detectaphone?

A. 1. A two stage amplifier from any radio set is used, the input being directly connected to the Magnavox. A pair of phones are connected to the output. With this system remarkable results are obtained, the device being very sensitive and faint sounds several hundred feet distant can readily be detected.

LIFE OF TUBES

(300) James R. Merton, Racine, Wis., asks:

Q. 1. Does reflexing shorten the life of tubes?

A. 1. The life of a tube depends only upon the way its filament is treated. For a 201A, whose filament voltage is 5 volts and whose filament consumption is .25 ampere to be operated at 6 volts with an insufficient rheostat control, the filament current will jump to .30 ampere. This increase of 20 per cent. in filament current lowers the life of the tube more than 80 per cent. In a reflex circuit or in any other circuit for that matter, a tube which performs a double function draws only on the "B" battery supply by its electronic emission. In an ordinary receiving set of three, four, or more tubes, the last tube must handle all the currents passed by the preceding tubes, and therefore causes a much greater drain on the "B" battery than the others, but the filament is in no way affected, except when the filament current is increased.

WAVE-TRAP

(301) F. E. Sturdevant, Columbus, Ohio, describes his receiving set and asks how he can place a wave-trap in the antenna circuit.

A. 1. Shunt an inductance coil of the required size across a variable condenser in series with the antenna.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

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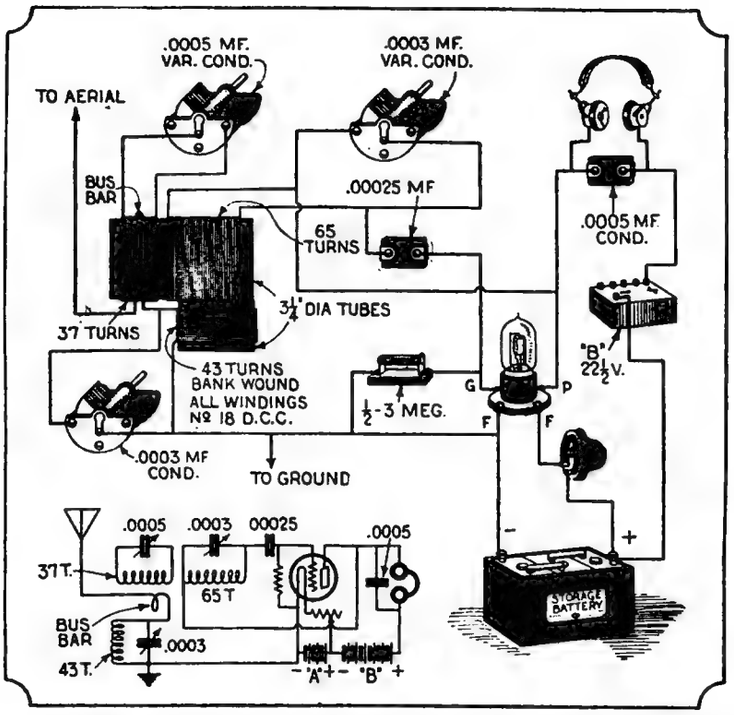
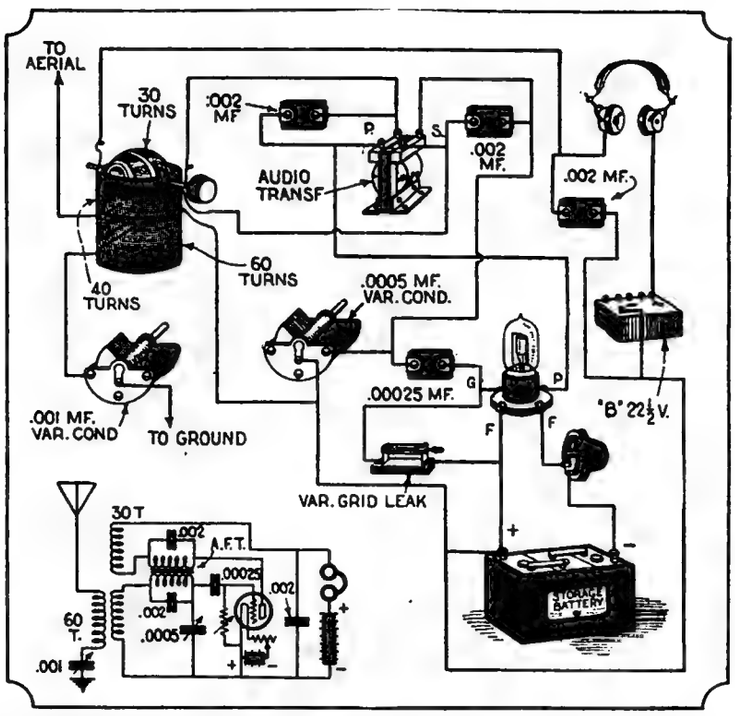


(Q. 302) The use of taps is soon to become a thing of the past and will be classified as obsolete. To overcome the difficulties in their use, a variable condenser is shunted around the coil. This is the most efficient way of varying the wave-length.



(Q. 306) One tube can be very successfully used to function as a detector and audio frequency amplifier. However, the use of one tube as a radio frequency amplifier detector and audio amplifier has not been successfully solved. A detector tube acts as a radio frequency amplifier.

COCKADAY CIRCUIT

(302) Robert Lonergan, Wenatchee, Wash., asks:

Q. 1. Kindly publish the Cockaday circuit without the use of a tapped bank wound inductance coil. As I detest taps I would very much prefer the use of a condenser or other means of tuning it.

A. 1. The circuit you desire is shown in the drawing.

DIELECTRIC CONSTANT

(303) Arthur Mansfield, Rochester, New York, asks:

Q. 1. Kindly give me the reason why mica is used instead of paraffin paper in fixed condensers and also define dielectric constant?

A. 1. The dielectric constant of a substance is the ratio of the capacity of a condenser when its plates are separated by a substance, to its capacity when its plates are separated by air. Paraffin paper has a lower dielectric value than mica and is much inferior for the reason that it absorbs moisture more readily than mica, and cannot withstand potentials as high.

Mica has an average dielectric constant of 6. Due to the extreme thinness of the mica and this high dielectric constant, it is possible to obtain high capacities in small fixed condensers. Air is the unitary dielectric, but is used mostly for variable condensers. The closer the plates of a condenser are, the greater the capacity, hence if a fixed condenser of a known value were put between the jaws of a vise and compressed, its capacity would rise above its rated one, but this condenser could not possibly withstand the voltage under which it was tested at first.

OSCILLATION

(304) S. B. Brown, Chicago, Ill., says that his set has suddenly stopped oscillating, not having done anything to it except to add a fresh set of "B" batteries. He asks:

Q. 1. I cannot see what has happened. Can you explain this?

A. 1. First see that there are no broken connections in the set. Check up on the storage battery to see whether it has not fallen too low. If lower than five volts, recharge immediately. The tubes may have been paralyzed by an excessively high plate-voltage. Disconnect the "B" battery and allow the filament to burn for half an hour at normal filament voltage. Tighten up feedback coupling. In many cases after a 10% reduction in the diameter of the filament due to volatilization, the efficiency of the tube falls off very appreciably and it becomes necessary to burn the filament more brightly.

TROUBLE IN CRYSTAL SET

(305) Bernard Dettling, Johnstown, Pa., says he has built the crystal set according to Fig. 2, page 54, of the May issue, but received no results with the same. He asks:

Q. 1. Can you help me out?

A. 1. The set described is the all around best crystal hook-up and you should have no difficulty whatsoever in receiving signals. Perhaps your fixed condenser, which is shunted across the phones, is shorted. Remove it and try tuning slowly and readjusting the crystal detector. Be sure you have a good sensitive crystal. Make sure your variable condenser is not shorted; blow all the dust from all the plates and tighten up bearings. This circuit must work perfectly if these conditions are fulfilled.

SINGLE TUBE IN TRIPLE ROLE

(306) Norman Sigler, Syracuse, New York, asks:

Q. 1. Kindly give me a hook-up that employs one tube having the three functions of detection, regeneration and audio frequency amplifications.

A. 1. The circuit you desire is shown herewith.

RADIO TO AUDIO FREQUENCIES

(307) O. T. McIlvaine, Cleveland Hts., Ohio, asks:

Q. 1. In how many different ways can a radio frequency current be made audible and what are these means?

A. 1. There are several ways of rendering a radio frequency signal audible. Some are very good, others relatively poor. In the order of their respective sensitivity, they are:—the Audion, the Fleming valve, the crystal, the high frequency alternator (as a Heterodyne), the electrolytic, the tikker, the microphonic, the magnetic, and the coherer detectors.

200 ILLUSTRATIONS—100 ARTICLES

is the average of every issue of RADIO NEWS. We doubt if there is a radio magazine in print that can show the diversity of articles and illustrations that is found in this magazine.

But above all, it is the quality of the material that is of prime importance to the man interested in radio. RADIO NEWS appeals to all factions; the Scientist, the Amateur, the Experimenter, the Broadcast Listener, and the Manufacturer. Each will find articles written especially for him. Every issue of RADIO NEWS is a radio education by itself. Sold on 35,000 newsstands in the United States and in every international book store in every civilized country the world over.

A LIST OF INTERESTING ARTICLES APPEARING IN THE OCTOBER ISSUE OF RADIO NEWS

Music From Your Lamp Socket. By R. D. Duncan

The Biography of Lee DeForest. By W. B. Arvin.

Crystodyne Receivers and Amplifiers. By I. Podliasky.

Duet with Singers 3,000 Miles Apart to be Broadcast.

Pilot Interviewed by Radio While Flying. By A. M. Jacobs.

Notes on the Super-Heterodyne. By Prof. Grover Ira Mitchell.

Reflex Radio Receivers In Theory and Practice, Part II. By John Scott-Taggart.

Non-Radiating Regenerative Receivers. By Clyde J. Fitch.

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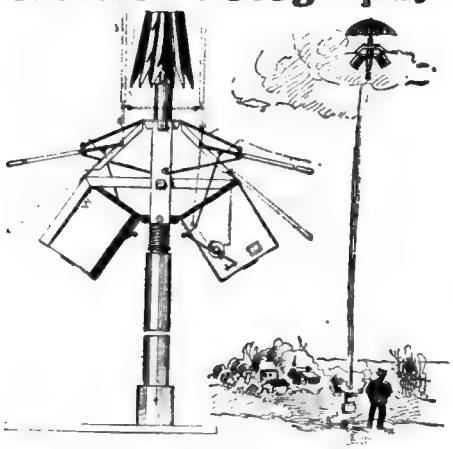
LATEST PATENTS

Aerial Photography

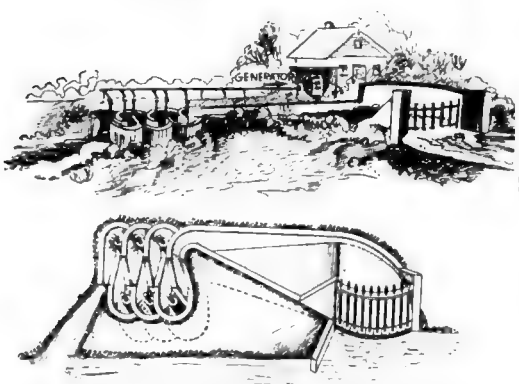


1,490,239, issued to Clifford B. Taylor. The parachute carrying the camera is shot into the air by means of a small cannon loaded with gun powder. At its extreme height the parachute opens and allows the camera slowly to descend. When the parachute opens it operates the shutters of the camera, thus taking the pictures.

Pulse Recorder

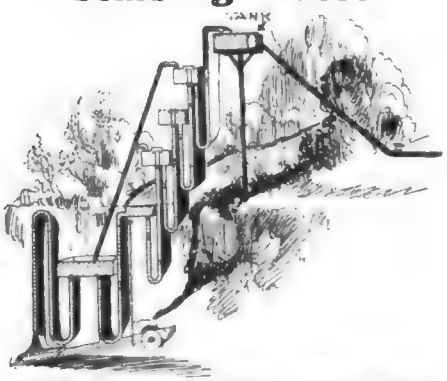
1,494,868, issued to Frank B. Sanborn. By communicating the differences in pressure of the veins and arteries to a tube and sensitive diaphragm to which a needle is attached, this device gives an accurate record of the circulatory condition of the individual under test.

Water Power



1,456,212, issued to James A. Bishop. By passing a stream of water through a number of baffles such as those shown in the above illustration and by placing a water wheel in the extremity of each baffle, a very efficient generator of power is obtained from the fall in the stream.

Raising Water



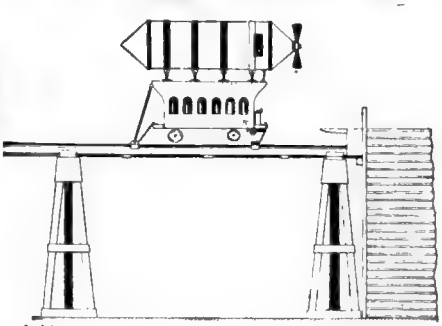
1,444,442, issued to Thomas Gaskell Allen. This system of raising water above its own level with the assistance of air pressure was described fully in SCIENCE AND INVENTION a few months ago. This is the patent covering the device then shown.

WANTED

ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

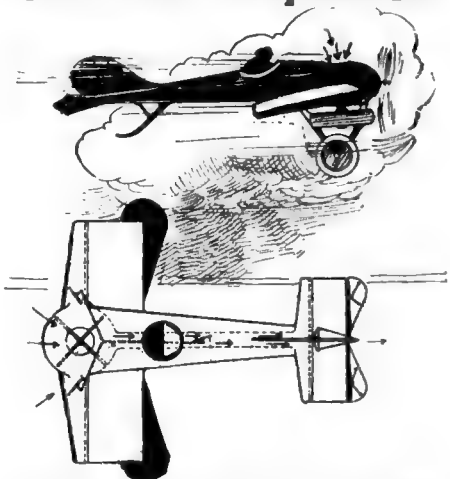
MOTOR CAMPER & TOURIST
53 Park Place,
New York City.

Aerial Transport



1,468,507, issued to George F. Nilsson, Sr. This invention seeks to increase the speed of transportation by removing the wheel friction and rail friction and by making the transportation car a cross between the dirigible and an ordinary street car, the power is taken from the rails and propulsion is through an air propeller fixed in front of the gas bag. The gas bag contains hydrogen or helium.

Aircraft Propulsion



1,491,954, issued to Leon H. Jacobs. Taking advantage of both heliopter and forward motion, this device sucks the air in at the nose of the plane, forces it through a channel, and out at the tail of the plane. A propeller is used to pull the air in and force it back, which, as in ordinary planes, pulls the machine forward.

Blotting Device

By placing a small blotting roller in a compartment attached to the top of a fountain pen, an extremely simple and handy kink has been devised. The blotting roller is renewable simply by removing it from the compartment at the top of the pen.

Car Washer

1,462,909, issued to Stanley F. Gulba. By placing a small turbine in a special nozzle and attaching the turbine to a rotary brush at the end of the nozzle, this patent fills a long felt want for garages. A stream of water uses its force to turn the cleaning brush and then flows on to the car body, acting as the washing substance, thus being used twice and making for efficiency.

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Scientific Humor

SHIFTY GENTS

I'm careful in my dealings with elevator men.
They are liable to take up, run you down, and let you out.
They never move without pulling wires.
You've got to be up and down with them.
You give them the floor, and they tell you where to get off.
You can't believe them; they never stay on the level, always shifting from one story to another. Sad but true!
—*Myer Skolnick, Reporter No. 13,440.*

SHOULDN'T HAVE TAKEN HOLT

An electrical mechanic named Holt,
Tried to tighten a lightning bolt.
When he opened his eyes
He said in surprise,
"It must have been more than one volt!"
—*C. A. Swoyer.*

WHY HE WAS IN SO LATE

During a recent thunderstorm, Jones, a wireless fiend, went out into the dark and stormy night, lowered his aerial and carefully buried one end of it in the soil.

Next morning, as he was going to town in his train, he told a fellow traveler what he had done.

"But, weren't you afraid of the lightning striking you?" queried a rather incredulous listener.

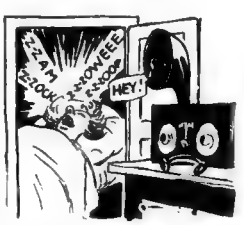
"No!" firmly replied Jones, "You see I had some silk pajamas on, and I read that silk is a good insulating covering."—*Ronald W. Etherington, Reporter No. 12,739.*

REDUCTIO AD ABSURDUM

VERY STOUT CHEM. TEACHER: "Is carbon a good reducing agent?"

BRIGHT BOY: "I don't know, but you might try some."—*Robert Courath.*

THE BED VIBRATED



MOTHER: "Willie, shut off that radio set and come to bed. That oscillation sets me crazy."

WILLIE: "Ma, I am in bed. That ain't the radio."

MOTHER: "What is it then?"

WILLIE: "That's our new cook snoring."
—*Noel Compton.*

"DRUG" OUT OF HIM

BOY (in a drug store): "I want a bar of Iron Soap."

CLERK (amusingly): "Maybe you mean Castile Soap?"

BOY: "Yes, that's what it is."—*Lester Kapala.*

HOPE THE FUSES REFUSED TO SIZE-LE

FOREMAN: "The load is too heavy for the size fuses you are using."

BONEHEAD ELECTRICIAN: "But I don't see why the load should be heavy enough to blow the fuses. The blueprint says this is a light circuit."—*Fritz Vanderwerth.*

First Prize $3.00

A VERY MODERATE SIZED ANIMAL

PHOTOGRAPHER: "I am going to fire that new assistant."

WIFE: "Why?"

PHOTOGRAPHER: "I told him to order a thousand lbs. of hypo and he went down to the zoo and ordered a hippopotamus."
—*J. C. Mello.*

A SPIDER HAS NO ANTENNAE

A city lad spending a day on a farm saw a spider spinning a web between two weeds. "Hey, Pop", he yelled, "Come here and see this bug putting up a wireless."—*R. S. Barenther.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, beside the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

SOME WHO SING IT TUNE IT OUT

Some citizens are now taking advantage of the fact that, when hearing our National Anthem over their radio, they can tune it out, rather than take the trouble to stand up.—*Charley Blood.*

THE BOMBARDMENT OF THE ATOMS

The football team of Science College marched to the field amid the roar and din of the scientific school yell, "Up and Atom."
—*Graham G. Berry.*

POP TRIED TO STAY ON TOP

LITTLE BOY TO FATHER: "Pop, why do people call the shed on an automobile a top?"

Boy's father, after a moment's hesitation: "Well, Sonny, I suppose 'cause they go for a 'spin' in them."—*Harry Walters.*

YOU'RE ON

The aviator's wife was taking her first trip with her husband in his airship. "Wait a minute, John", she said, "I'm afraid we will have to go down again."

"What's wrong?" asked John.

"I dropped one of my pearls and I think I can see it glistening on the ground."

"Keep your seat, dear," said the aviator, "that's Lake Huron."—*I. Weinert.*

AND IODIDE OF POTASSIUM

DEAR EDITOR: "I always knew that a chrom-ate and a chlor-ate, but will you tell me this: Can a sulp-hide?"—*Milton Koenecke, Rep. No. 12,230.*

A LEGAL LIGHT

PROF: "What's the moon?"

STUDENT: "It's a diffused headlight for lovers."
—*J. C. Mello.*

THE TEMPER IRONED-OUT

"What happened to your friend Steel?"

"Oh, Steel lost his temper and hit a Copper and Jidge Murphy gave him tin days."—*Charles R. Swift.*

WIRELESS CLOTHES LINE

NEIGHBOR: "I see your wife hangs the wash on your aerial."

RADIO BUG: "Yes, very convenient. When it has been out long enough, the loud speaker started singing 'How Dry I am', and she takes it in."—*Sam Y. Caldwell.*

THIS IS HOT

"Mazda, darling," he wrote, "be mine, Incandescent One! Watts life without you. Ohm is not ohm without the light of your presence. My heart is a transformer that steps up at every thought of you. I would insulate my head alongside your switch; the contact of your hand is like a live wire. Marry me, and let's have a little meter in our home."—*Wilbur H. Yost.*

NOT EVEN A DOLLAR A YEAR MAN

A woman who had been married several times and who could not get along with her husbands wrote an article on "What Men Are Made Of."

"Man", she began, "is made of enough sugar to fill a teacup, enough lime to whitewash a small chicken coop, iron enough to make a small nail, phosphorus enough for a box of matches, postassium enough to fire a small cannon, fat enough to make six bars of soap and enough copper to rid a dog of fleas. All of this would cost 98 cents, which I think is a high price to pay for some men."—*Ned Guffey.*

TAKES THE "FUSES" OUT OF "REFUSES"

HE (trying to start car): "This darned self-starter refuses to work. There is a short circuit somewhere."

SHE: "Well, why don't you lengthen it?"—*M. Kipp.*

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THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

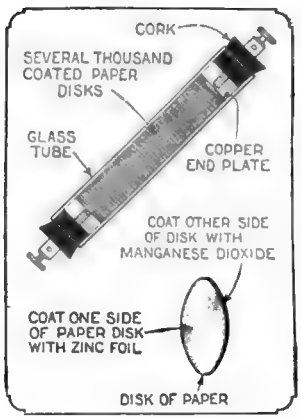
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

ZAMBONI'S DRY PILE

(1745) J. R. Crespo, Buenos Aires, Argentina, asks:

Q. 1. What is the so-called Zamboni dry pile and how is it made?

A. 1. This little device consists of a glass tube in which are placed several thousand paper disks which have one side coated with manganese dioxide and the other with zinc foil. In effect,


CORK
SEVERAL THOUSAND COATED PAPER DISKS
GLASS TUBE
COPPER END PLATE
COAT OTHER SIDE OF DISK WITH MANGANESE DIOXIDE
COAT ONE SIDE OF PAPER DISK WITH ZINC FOIL
DISK OF PAPER

The accumulation of electricity either in the static or dynamic form has been attained in many different ways. The interesting and curious dry pile of Prof. Zamboni is one of the most interesting. It is in reality a voltaic cell having a high potential.

it is a miniature dry cell having a tremendous high internal resistance and an exceedingly great terminal voltage,—a good dry pile yielding sparks several inches long. A cell of this nature will last several years and much fun can be had with it.

MIRRORS AT STREET INTERSECTIONS

(1746) James Collins, Springvale, Mo., wants to know:

Q. 1. Why not put large mirrors on street corners so as to reflect another street and thus view the traffic?

A. 1. Although a good suggestion, we do not believe that this would work out very well. In the first place, the reflection from these mirrors, either of the sun's rays or automobile headlights, would render the device objectionable. Secondly, the initial cost, the upkeep, replacement and maintenance would be too high for the ordinary municipality.

FLY PAPER

(1747) A. D. Stanley, Greenville, Ala., wants to know:

Q. 1. Can you give me the formula for making a suitable sticky fly paper? Would I infringe on any patents by the manufacture of a different design from those on the market today?

A. 1. Providing of course your design for fly paper is entirely different from those on the market today, you will not infringe on any design patent. To make a good sticky fly paper requires the use of 8 parts of rosin, 4 parts of rapeseed oil, and 1 part of honey. The rosin and the oil are melted together and the honey then added.

Talking Dynamos

If you were standing before a dynamo in a power station and suddenly heard it talk, you no doubt would be greatly astonished. How dynamos and transformers can be made to talk opens up a new realm of experiment to electrical students; and not only does this represent an interesting and novel line of experiment, but owing to the manner of making the iron molecules talk without any diaphragms, a new field is opened up for research work on radio loud speakers and telephone apparatus in general. Don't miss this wonderful article by Eugene J. Dwyer in the October PRACTICAL ELECTRICS.

Other articles in October PRACTICAL ELECTRICS are:

Vacuum Tube Oscillioscope
By Charles D. Savage.
Electric Chimes—By Earle R. Caley, B.Sc.
Induction Motors By Harold Jackson.
Talking Transformers and Dynamos
By Eugene J. Dwyer.
Photo-Electric Cells. By H. Vigneron.

SIMPLE SHOCKING MACHINE

(1748) John Dowalo, Donora, Penna., asks:

Q. 1. Can you kindly inform me as to the simplest way in which a shocking machine can be made?

A. 1. Attach one wire to the vibrator terminal of an ordinary bell and another wire to one of the terminals, both about two or three feet long and connect a knife to the end of each wire to be used as shocking handles. By wetting the hands and grasping the knives when the bell is ringing, a distinct shock can be felt. This is the simplest arrangement for a shocking machine.

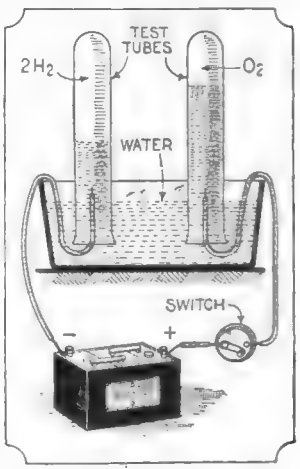
ELECTROLYSIS OF WATER

(1749) Harold Wris, Portland, Oregon, wants to know:

Q. 1. Is pure water a conductor of electricity? If so, kindly tell me how I can electrolyze it?

A. 1. While pure water appears not to conduct electricity, its resistance is greatly reduced by the addition of a few drops of sulphuric acid.

One of the commercial methods for obtaining oxygen and hydrogen in large quantities is by the electrolysis of water. The pure water is slightly acidulated by the addition of a small quantity of either sulphuric or hydrochloric acid. Platinum electrodes are used since they are not attacked by impurities or acids.



Two test tubes full of water are inverted into a receptacle containing water and the ends of two small platinum wire electrodes are inserted. By connecting a storage battery to the electrodes, the analysis of the water begins which breaks up into hydrogen and oxygen, twice as much hydrogen as oxygen being liberated. The chemical equation of this analysis is $2H_2O$ yields $2H_2 + O_2$.

ELECTRIC HEATER

(1750) Herman Forth, Brooklyn, New York, asks:

Q. 1. Can you give me any data on how to make a 2000 watt, 220 volt heater?

A. 1. For a 220 volt heater you should have No. 18 calido wire, which has a resistance of approximately .37 ohm per foot. At 220 volts, a 2000 watt heater will take 9 1/10th amperes or approximately 10 amperes, in which case R would be equal to 22 ohms. You will need, therefore, pproximately 60 feet of No. 18 calido wire. Mica porcelain, plaster-of-Paris and sand can be used as the heat resistive insulators.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 12,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR NOVEMBER SCIENCE AND INVENTION

Early American Patents.

Details of the Radio Knife, Medicine's Latest Discovery.

Stereoscopic Photos and Vision Without a Stereoscope.

A Novel Third Degree Method.
By Andv Gilbert.

A Miniature Universe.

Homo Artificialis—Man with Artificial Organs.
By H. W. Secor and J. H. Kraus.

Poison War Gases Cure Ills.

Radio Frequency Coupled Amplifier.

Experiments with the Solodyne and How To Make Them.

The Good and Bad in Your Aerial.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of **SCIENCE AND INVENTION** we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

Address all inquiries of this nature to **INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.**

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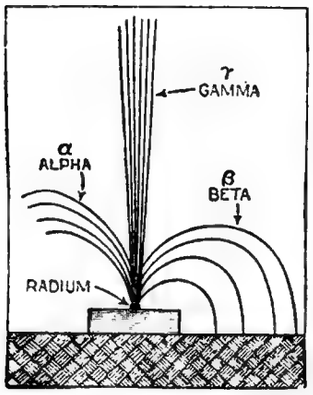
RADIO-ACTIVITY

(1751) John Belmar, Racine, Wis., asks:

Q. 1. Can you give me some information concerning radio-active materials?

A. 1. Shortly after the discovery of X-rays by Roentgen, Becquerel noticed that certain fluorescent bodies emitted similar rays capable of penetrating opaque substances. In 1898, two years later, Mme. Curie succeeded in isolating the most radio-active material known, which she named radium. Thorium and uranium are other radio-active elements.



It is well known that radium emits three kinds of rays. These rays are not identical, but have different properties. They are called alpha, beta, and gamma rays. The diagram shows the action of the rays in the intense field of an electro-magnet.

Experimentation by Rutherford proved that radium emits three kinds of rays known respectively as alpha, beta and gamma. The alpha rays which are known to be atoms have small penetrating power and when subjected to the action of a magnetizing force are deflected in a direction which shows them to be positively electrified. The beta rays are negatively electrified, have great penetrability and are similar in nature to cathode rays. The gamma rays are not deflected by a magnetic field, have very high penetrating powers and above all are ionizing. They have properties identical with Roentgen rays. Whereas the gamma rays travel with the speed of light, the beta rays travel as slow as 1/10th as fast and the alpha particles only 1/20th.

Radium, classified as an element, is itself a product of the degeneration of uranium and finally resolves itself into helium (given off as alpha particles) and an inactive product resembling lead.

Being, as it is, that all the uranium of the world is breaking down from its very complex structure to the more basic and inactive forms of lead, we have no source from which we can draw. Of course, thousands of years will pass before all the radio-active elements disappear entirely. Pitchblende from which radium is obtained, is relatively cheap and many tons of it are required to produce a few milligrams of the wonder substance.

ELECTRIC SPOT WELDING

(1752) Peter Zasadny, Chicago, Ill., wants to know:

Q. 1. Is it possible to weld two sheets of brass on an electric spot-welding machine and can it be successfully done?

A. 1. It is entirely possible to electric spot-weld two sheets of brass together. Electrical welding will accomplish what other means of welding cannot do. Almost any metal can be welded to any other kind; aluminum to soft iron, steel to zinc, etc. Electric spot-welding is one of the most successful, if not the most successful means of accomplishing a permanent joint between metals.

RELATIONSHIP OF INPUT TO OUTPUT

(1753) C. Price, Wichita, Kansas, asks:

Q. 1. Will you please advise me what the proportionate or relative power of a solenoid is to the power required to energize the solenoid?

A. 1. Of course, the power applied to a solenoid is equal to the power generated by one, minus leakage and frictional effects. It is always safe to figure 25% as a safety factor.

EVAPORATING WATER

(1754) Chas. Warner, Philadelphia, Pa., asks:

Q. 1. Can you give me some methods of evaporating water chemically?

A. 1. In order to evaporate water chemically, the means of accomplishing this are varied. You can use dry calcium chloride crystals which are hygroscopic and by their mere presence in an aqueous vapor atmosphere will absorb all the moisture. A shallow pan of concentrated sulphuric acid will also readily accomplish this. Heat is not necessary and the water, as you can readily see, will be evaporated at a very slow rate.

TESLA COIL QUERY

(1755) Robert Howorth, Englewood, New Jersey, asks:

Q. 1. Will a Tesla coil operate if wound with a multi-layer winding?

A. 1. No. It is very inadvisable to wind a Tesla coil with a multi-layer winding inasmuch as the voltage per turn is so excessively high that the insulation between turns is not sufficient to prevent break down and hence such a coil will not work efficiently. The winding convolutions should be spaced at least 1/32nd of an inch apart.

WHAT IS ELECTRICITY?

(1756) James Weston, Chicago, Ill., asks:

Q. 1. Are there any institutions which would pay for the knowledge of knowing what electricity is? Have been working on the problem for many years and believe I have it solved.

A. 1. Scientists ever since the discovery of loadstone have been trying to solve the problem of "What is electricity"? Although they haven't given up in the face of things, the problem is by far too complex to offer any substantial theory. Scientists all over the world today are hard at work on it. If you have any ideas concerning the nature of electricity, we would advise you to write to the nearest college or university and ask permission for the use of their laboratories to carry out your experiments. We know of no institutions that will pay for this knowledge, but we do know, however, that you will be more than amply reimbursed once this knowledge is gained.

REFRIGERATING MACHINE

(1757) Edward D. Stein, Bronx, New York, asks:

Q. 1. Kindly explain the theory of operation of a simple refrigerating machine?

A. 1. The principle of operation of a refrigerating machine for cold storage and ice making depends on the condensation and evaporation of ammonia.

Ammonia gas is compressed by a pump A, and passed into a condenser, B, where a continuous stream of cold water removes the heat developed by the compression and condensation. In its liquid form, the ammonia is led through a pipe leading into the room to be cooled. Here it passes first through a valve, C, which has a very small opening. This holds the ammonia back, choking the flow and keeping it in a liquid state under pressure. Beyond this valve, the ammonia is free to evaporate rapidly and expand. This process takes up considerable heat and with a large cooling surface due to the long coils of pipes, large storage rooms are quickly chilled. The frost that coats the pipes is due to the condensation of moisture in the room. The pipes contain brine which does not freeze as water would at the temperature attained.

IMPORTANT

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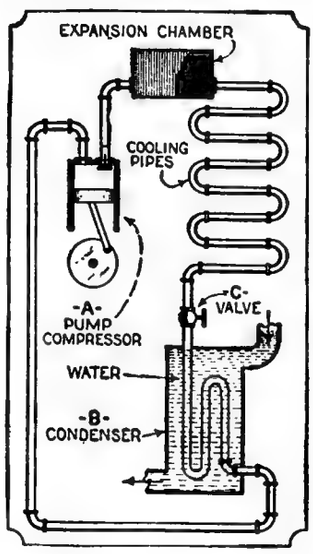


The refrigerating machines used for ice making on a large scale and for cooling rooms for cold storage, depend on the condensation and evaporation of ammonia. Salt water or brine is pumped through the pipes at the same time and thus prevents the water in the condenser from freezing. Very low temperatures have been attained with the use of these machines.

EINSTEIN'S THEORY

(1758) William J. Bentley, Rochester, New York, asks:

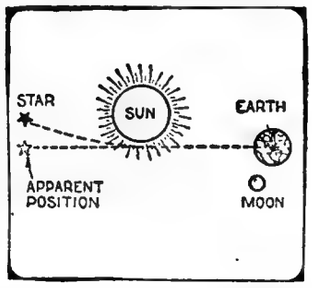
Q. 1. Kindly summarize Einstein's theory?

A. 1. In summing up Einstein's theory we find that it rests upon the following novel ideas, and combines them into a new conception of the universe:

(1) There is nowhere any fixed standard by which the motion of anything can be measured. The theory of a stationary ether is put out of court.

(2) The speed of light alone is independent of all other motions, and is the same for all observers, everywhere.

A light beam from a star, according to Einstein followers, is bent as it passes the sun. This is one of the practical tests applied to the Einstein theory.



(3) Time is not independent of space, or of motion. If two objects are in relative motion, both time and length, as observed from either object on the other vary with the ratio of their relative motion or speed, to the speed of light.

(4) Time plays the part of a fourth dimension, so combined with the ordinary dimensions of matter (length, breadth, and height or thickness) that together they make up a "continuum," or continuous, inseparable medium, called space-time.

(5) Space-time is different in its structure from what we ordinarily think of as space, and ordinary geometry does not apply to it. It has an internal warp or curvature, which is greatest near massive (heavy) bodies.

(6) Gravitation (cause of the falling of bodies) is not due to an "attractive force" but is simply a natural consequence of the "curvature" of space-time.

(7) At least two important physical confirmations of the Einstein theory have been found:—First, the observed bending of light from stars passing close to the sun, which Einstein predicted as a result of the peculiar structure of space-time,—and second, the slow swinging round of the perihelion point of the planet Mercury, an effect that the Newtonian theory of gravitation did not satisfactorily explain.

MOTOR GENERATOR QUERY

(1759) James Murphy, Los Angeles, Calif., says he has a 110 volt 4 pole shunt wound D.C. motor, taking 10 amperes and running at 1200 R.P.M., and desires to rewind it to run at 220 volts so as to run it twice as fast. He asks:

Q. 1. Can you give me any information on how to effect any changes?

A. 1. Since the speed is directly proportional to the voltage, the machine will run at 2400 R.P.M., and it will not be necessary to rewind the armature.

The field coils, however, being wound for 110 volts, will have to be rewound with the same weight of wire, which wire shall have one-half the cross-sectional area of the original wire, and thus have twice the number of turns.

Q. 2. Can this motor be used as a generator and at what speed should it be run in order to produce 220 volts, the resistance of the armature being 1 ohm and the current consumed by the shunt field when running as a motor being .5 of an ampere?

A. 2. Since in rewinding from 110 volts to 220 volts, you quadruple the resistance and at the same time increase the voltage to twice the original, the current in the shunt field becomes ½ the original value. Then use the following formula:

$$NG = NM \times \frac{(EG + IGR)}{(EM - IMR)}$$

Where

NG = R.P.M. of generator.
NM = R.P.M. of motor.
EG = Terminal voltage of generator at full load.
EM = Terminal voltage of motor at full load.
IM = Armature current in generator.
IG = Armature current in motor.
R = Armature and brush contact resistance.
R = 1 ohm.
IM = 10 — .25 = 9.75 amp.
IG = .10 + .25 = 10.25 amp.
EG = 220 V.
EM = 220 V.
NM = 2400 R.P.M.
NG = R.P.M. to be found.
NG . ·. = 2616 R.P.M.

Thus it will be necessary to run the motor at 2616 R.P.M. to produce 10 amperes at 220 volts. A field rheostat in series with the fields is necessary to control the voltage at no load which is higher than 220 volts.

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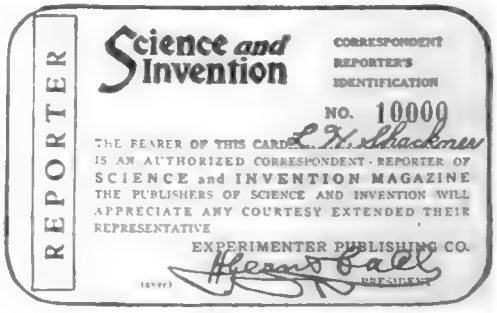
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The Living Death

By JOHN MARTIN LEAHY

(*Continued from page* 555)

Glad have I lived, and I believe that I can, like Stevenson, gladly die. The only question is: what time remains to me? A day, a week, a month, six months? Who can tell?"

There was a pause. A moment, and a smile touched the captain's face.

"Well, what does it matter?" He made a gesture of resignation. "Life cannot be very rosy to a man who knows that any breath he draws may be his last. If I can only live to tell you my story! And I can await death with resignation when I have told you all if you will enter upon this undertaking."

"I must first," suggested Frontenac, "know what that undertaking is."

QUESTIONS

"A terrible one," Livingstone answered. "But, before entering upon my story, Mr. Frontenac, I am anxious to know if the version which we have of your discovery is correct."

Darwin Frontenac nodded.

"Yes; substantially it is correct—though the accounts are somewhat exaggerated."

"Then you really can bring an animal back to life?"

"Hardly that," Frontenac smiled. "It is not dead; the animal is merely in a state of suspended animation."

The captain looked puzzled.

"If an animal is frozen stiff, incased in a solid block of ice—is not dead, then what is it? Surely it is not living."

"No," said Darwin Frontenac.

"And it isn't dead?"

"Of course not."

"That," said the captain, "is just what poor Hampden said."

"The condition," I put in, "in which we find it in its block of ice must be one new to science."

"By no means, Bond," returned Frontenac. "If it were dead, life could not be restored. But life may be restored from suspended animation after many years—thousands of years."

"Thousands?" exclaimed the captain.

"Thousands, so I truly believe," Frontenac nodded.

"And if it were living?" I queried. "You say that it is neither alive nor dead."

"If it were living, we could kill it."

"Good Heaven, can't we do that?"

"No," said Frontenac, "in that state of suspended animation, remember. We kill it—if death results—not in its state of suspended animation, but in the *very act of restoring it to life.* What I am striving to express is this: What science calls suspended animation is neither life nor death."*

The captain and I looked at each other; the captain shook his head.

"That is what Hampden told me," he said. "I'm afraid, though, I do not grasp it.

"However," he added, "I can see there is a difference *if the animal is drugged* before it is frozen."

I thought a faint smile touched the corners of Frontenac's mouth, but he made no comment.

CHAPTER III

INCASED IN ICE

"That is what gives me hope," the captain added. "As I understand it, you

*"If, as seems certainly to be the case, the animal dies because in the very act of trying to restore it some inequality in the process is almost sure to determine a fatal issue, some vital center passing into the pectous state, the animal could not have been dead before restoration was attempted; for the dead cannot die again."—R. A. Proctor.

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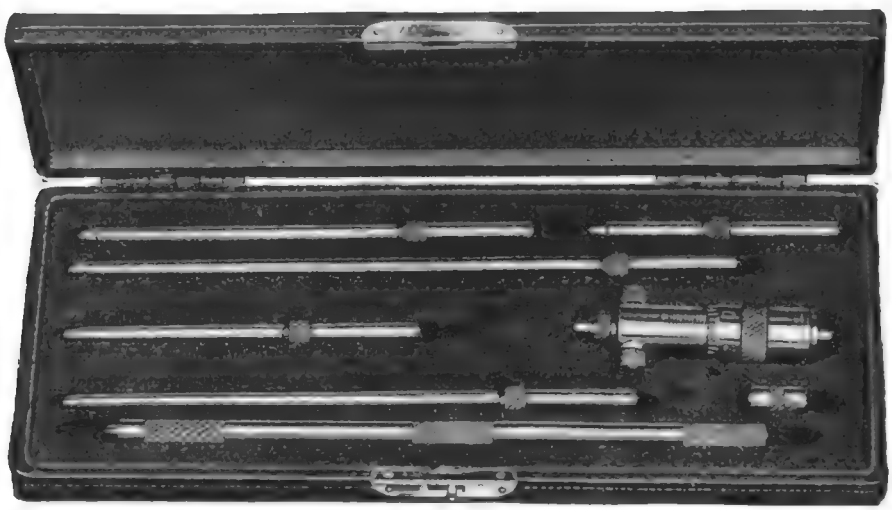

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produce with some drug, a state of hibernation, so to speak, and maintain this condition by freezing; and that any time you wish restore the animal to normal activity and life."

Frontenac nodded. "That is just what I do. Suspending the vital processes is the easiest part of the matter. Some of the chemical agents capable of producing the semblance of death have long been known—mandragora and belladonna, for instance, and others of the Solanaceae. Dioscorides employed plants of this order, though it is uncertain whether he speaks of belladonna, mandragora or datura stramonium. Belladonna is, perhaps, the *strychnos manicos* of the ancients. The effects of all these agents are similar, though the dose must be varied to secure the same results.

"To these may be added amyl nitrite and chloral hydrate. The latter is very effective in suspending the vital functions.

"However, the agent employed in my work is none of these, but a discovery of my own. There are undoubtedly hundreds of such agents in organic chemistry and I have chanced upon one of them."

The captain leaned forward; eagerness marked his expression; also, I thought, there was something akin to fear in his look.

"If one of the old drugs has been used, belladonna, let us say, would that mean that the chance of a complete recovery would in any way be diminished?"

"No," Frontenac told him, "provided always, of course, that the drug was not administered in a quantity to prove fatal *before the subject was frozen*. My agent possesses some marked advantages, that is all: I can not say it adds to the certainty of the recovery."

THE EXPERIMENT

The captain settled back in his chair with an audible sigh of relief.

"I thank God for that," he said. "For then there is hope."

Frontenac waited, hoping, no doubt, that the other would go on; but the captain seemed to have fallen into a profound reverie.

So Frontenac continued: "To the general public I am a faker. It makes me a little sad, though, to hear what some men who ought to know better think of my work. They seem to be utterly ignorant of what has been done along this very line. The marvels of hibernation (and estivation) should have shown them the virtue of true scientific caution.

"In a state of complete hibernation, animals—mammals, remember—live for months without drawing a single breath. That respiration is completely suspended was proved long ago by Spallanzani: he left a marmot for four hours in carbonic acid gas, repeating the experiment with a bat as the subject. To a *breathing* mammal, it is scarcely necessary to remark, this gas proves almost instantly fatal. Also, as a further proof of the complete suspension of respiration, the oxygen was found unaffected after a bat had remained in a pneumatometer for ten hours.

"As for my own experiments, I will mention but one: I kept a bat for two whole months in a vacuum as perfect as could be made, and it still lived. A little vapor of ammonia brought him out of his long snooze as though nothing whatever had happened.

"However, the blood of an animal in a condition of complete torpor continues to circulate, though slowly; and this marks the great difference between hibernation and artificial suspension of vitality."

"I knew," said the captain, "that some strange things could be done with cold-blooded creatures; but I never dreamed such marvels were possible with warm-blooded mammals."

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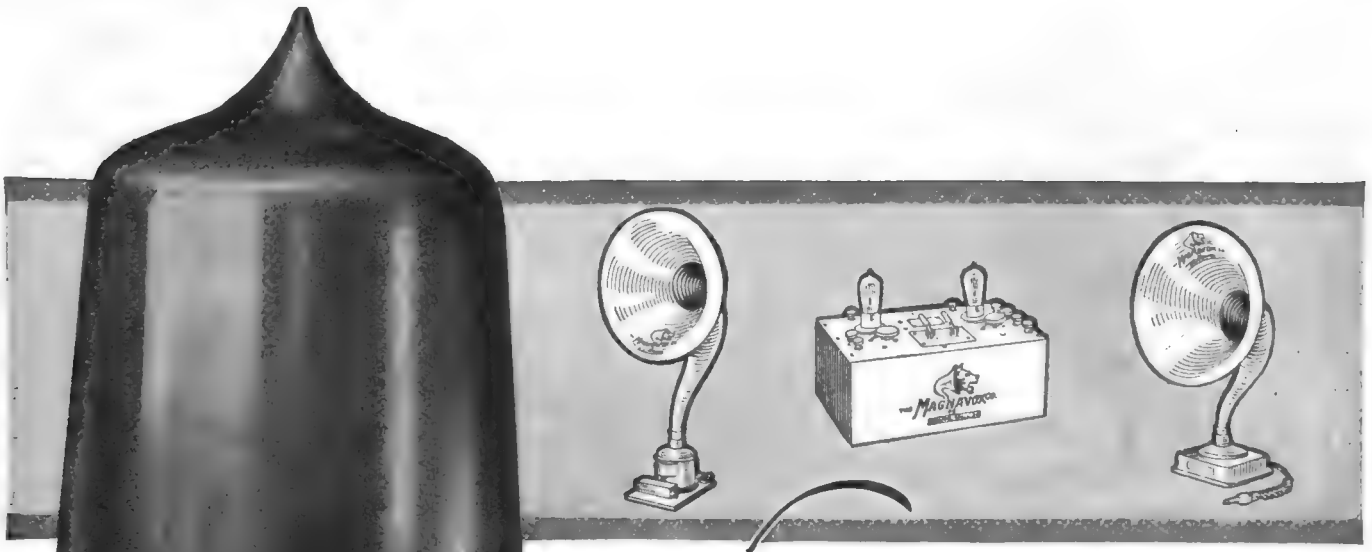

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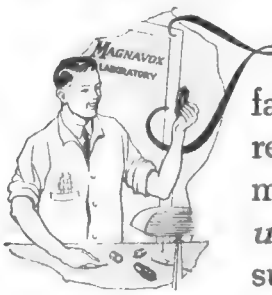

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if he only knows how," said Frontenac. "The thing is more difficult, that is all. At any rate, such is my belief. It is not impossible.

"It has long been known that fish can be restored to perfect life though completely frozen. Why, then, all this excitement of the public because I have succeeded in resuscitating a frozen mammal?"

"I had heard," said the captain, "that fish frozen in solid ice could be thawed out and brought back to life; but I confess I had some doubts as to the accuracy of the story—even though Hampden said it was so. I placed it in the same category as those stories of petrified men."

Darwin Frontenac arose. "Would you care to see it done?"

"Would I?" exclaimed Livingstone.

"I'll fetch a fish from the freezer," Frontenac said, "and show you."

He turned and left the room.

Livingstone gazed at me for some moments with a quizzical expression.

COMMERCIAL POSSIBILITIES

"No doubt, Mr. McQuestion, this is somewhat matter of fact to you; but to me it is very strange. And I assure you, sir, that I have seen some strange things in my day—as you will see when I tell my story."

"It is just as new and strange to me," I said. "And, you know, apart from its scientific interest and value, the discovery has great commercial possibilities."

"Oh," the captain nodded, "probably."

I wondered at the man's obtuseness.

"Great!" I ejaculated. "Why, the possibilities of this discovery are unlimited."

The captain looked at me questioningly.

"Probably. But—that is—well, in what way, Mr. McQuestion?"

"In what way? Why, for instance, if you want to ship livestock from the Western ranches to the great packing-houses, simply *kill* the animals and pack them in the freezing cars like so many hams or slabs of bacon, like so much cordwood. Think of the saving in fodder—to say nothing of the freight!"

"And here's another application. During the long winter months, what a saving for the farmer! The stock which eats but gives no value will be killed, piled in the freezer, save a winter's feed. Simple, isn't it?"

"Oh, yes. Undoubtedly, as you say, Mr. McQuestion, there are—well—ahum, great possibilities in that direction. But there are greater, more interesting, more wonderful possibilities elsewhere."

At this moment came the sound of footfalls, and soon Frontenac entered—a pail, heavy with water, in one hand, a piece of ice in the other. The fish, a trout about seven inches in length, could be seen plainly encased in the ice, as though held in glass. The captain's hands trembled as he examined the little creature. He turned the ice this way and that and over and over.

"And, Mr. Frontenac," the captain exclaimed suddenly, his voice eager, his eyes wistful, "you can thaw him out, make him live once more?"

"Of course. That is what I am going to do now—though the fish is not dead, else it could not be done."

"And tell me," exclaimed the captain, his voice shaking a little, "could you restore a *human being* if frozen thus in solid ice?"

Frontenac scrutinized the captain closely for a moment, and asked "A human being?"

"A human being—yes."

"I believe," Frontenac told him, "I could."

"I know you can!" the explorer cried.

"Captain Livingstone, what do you mean?"

There was a brief silence. "It means that—well, you see——" He raised a finger and pointed to the fish, resting again in Frontenac's hand. "I am as anxious to tell you what I found down there, Mr. Frontenac. But the fish. The story as soon as I see that trout swimming once more."

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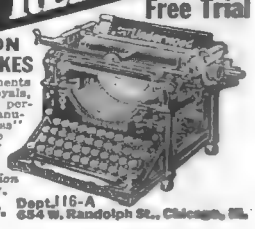

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"That you will soon see, Captain. For I dare say you are not nearly so anxious to see this creature restored to life as I am to hear what you have to tell."

CHAPTER IV

THE CAPTAIN BEGINS HIS STORY

In silence Darwin Frontenac proceeded with his thawing. The captain and I sat watching.

More than once my look lingered on the explorer's face, held there by that strange, indescribable expression which had come over his weather-beaten features.

And, while watching, I kept wondering about the story the man was to tell us. Strange was this scene before me, Frontenac in the act of restoring to life a fish that had been incased in solid ice for months. I found myself growing impatient. The captain's story, I thought, would be of things even stranger than this experiment of Frontenac's.

I kept turning over in my mind the few words he had uttered, endeavoring to find some idea which would cast a bit of light on the forthcoming story.

Her. What had he meant by her? Who was she? What was she, where was she? A woman in the Antarctic? His words could mean nothing else. No woman had ever set foot on the Antarctic Continent, according to all accounts. And Frontenac to head an expedition to this land of snow and ice (and, if one could believe our captain, palm-trees) to save her! From what? From one of the foulest of deaths, the captain had said, or from sleep eternal.

THE FISH SWIMS

My musing was interrupted by an exclamation from the captain—a boyish exclamation of surprise and joy. The fish, now wholly free from its ice, was showing unmistakable signs of life. And the interval was not a very long one before he was swimming slowly around the pail as though nothing unusual had happened to him.

"Who would have believed it?" exclaimed Livingstone.

"I don't see what there is so very strange about it," Frontenac said. "In my mind, hibernation or estivation is more wonderful."

"Or," added the other, "the artificial suspension of vitality in warm-blooded creatures."

"Yes," nodded Frontenac; "or the artificial suspension of the vital functions—and their restoration."

"Of course," the captain added, "I realize that, in an ultimate sense, nothing can be any stranger than anything else. But it seems so to us, because, through our own ignorance or through the teachings of others, we come to believe things very possible are simply impossible. For instance, we are taught that life is a weak thing, whereas it seems no one knows how strong it really is."

"No one knows," said Frontenac, "or can know. And those who ought to know how wondrous and mysterious it is are the very ones we find so cocksure and dogmatic. For instance, these fellows declared life was utterly impossible in great depths of the sea. There was the frightful pressure; no living thing could stand it for an instant. And the total want of light; those depths are pitch black. And then came deep-sea dredging, and, to the amazement of the scientific know-it-alls, those deeps in which no creature could exist even for a single instant were found to be teeming with a myriad forms of life."

The captain nodded.

"Some of these scientific gentlemen are the very personification of cocksureness when, as a matter of fact, they haven't a single toe to stand on. I remember, for instance, how the great scientist Croll *proved* that there could be no elevated land in the Antarctic."

Frontenac nodded.

"Yes; I remember that, too. Had there been mountains, tablelands and so on, the

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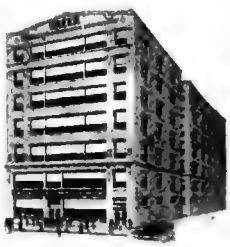

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A LESSON ON CHIROPRACTIC

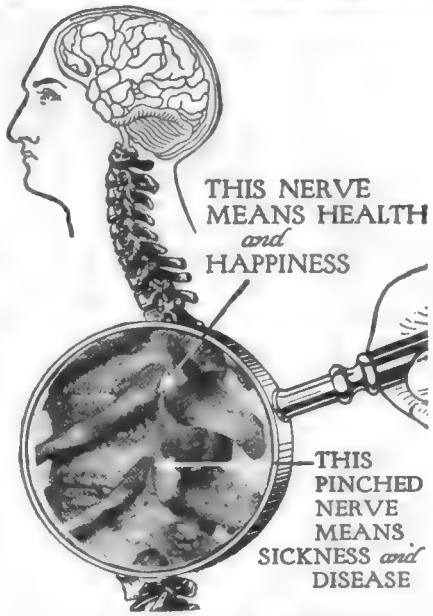
WHEN you wish your arm, hand, leg or any other part of the body to do something, a message is sent to that member over the nerves.

If the nerve over which the message travels is pinched, the message cannot get to the member to which it was directed; the member does not obey the mind, and it then is what we call diseased.

Chiropractic teaches that all the work that is done in the living body is done by an intelligent power within by means of functional impulses sent over the nerves, and that disease is the result of an interference with the normal transmission of these functional impulses over the nerves.

Chiropractic teaches that your arm or leg will obey the mind if the channel over which the moving or motor impulse is open and normal, but that if a segment of the spine becomes slightly misaligned and presses on the nerve, thereby stopping the motor impulse, the result is what is called paralysis.

The accompanying cut shows how the nerves, over which all functional impulses are sent, come out through the spinal windows between the vertebrae, and how a misaligned vertebra may press upon or impinge



the nerves, thus interfering with the flow of functional impulses, which causes dis-ease.

To adjust the vertebra to normal, thereby removing the cause of disease, is the work of the chiropractor.

Thousands have realized that paralysis is simply a lack of motor impulse to the affected part, when complete recovery followed the release of the prisoned functional impulse through the adjustment of the misaligned vertebra by a competent chiropractor.

And Yet Some Say: "I Don't Believe in Chiropractic" What a Pity!

The Hon. J. R. Morly, of Owatonna, Minn., under date of November 4th, 1922, says:

"In June, 1919, I met with a severe automobile accident which injured my spine. As a result of the injury I became paralyzed on the left side. My left hand and arm were practically dead and my left leg was so affected that I could only walk with someone to support the left side. My family and friends were much concerned and doubtful about my recovery. I immediately consulted a chiropractor, who advised me to have a spinograph taken. After this I commenced taking adjustments and have now regained the use of my left hand and can walk naturally. I would advise anyone suffering from similar trouble to consult a chiropractor."

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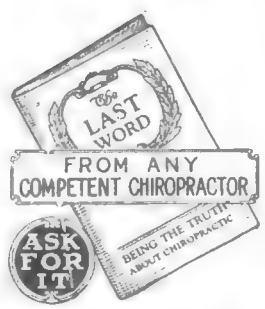

bergs would have shown tilted and broken stratification, whereas the strata were always horizontal."

"Just so. And yet," said the captain, "when Roald Amundsen and his four companions raised the flag of Norway over the South Pole, they stood nearly two miles above the level of the sea."*

"A good lesson, that," nodded Darwin Frontenac, "in scientific caution."

"Our scientists certainly need it," said Livingstone. "Perhaps the bitterness I feel on this subject is not wholly warranted, but it was a scientist who first covered me with ridicule and—well, worse."

"But ridicule and worse are what the discoverer should be *prepared* to meet. There is an old saying that Truth finds foes where she makes none."

"But one doesn't expect to find foes in the very palace of Science herself."

"One should expect to find them there," Frontenac told him, "for your scientist, with all his learning, is but a man, a man with weaknesses and passions very like those of the butcher, the baker and the candlestick-maker.

"The scientist, Captain Livingstone, is often myopic or blind when the intelligent layman sees things very clearly. Have you forgotten Agassiz and evolution? That Francis Bacon rejected the Copernican system, as did the great Tycho Brahe, and Leibnitz the law of gravitation? That Darwin's name was rejected by the French Academy of Sciences, that those omniscient academicians *suppressed* Peyssonel because his observations showed coral not to be a plant but an animal? And, coming down to our own day, that scientists, showing about as much courtesy as we find in a political campaign, have for years declared the lines cobwebbing Mars are optical illusions.

"At the risk of offending you, Captain Livingstone," Frontenac finished, "I will say——" But Frontenac did not say it.

"Well, sir?" demanded the captain. He had straightened up in his chair and fixed his look on the other—the gray eyes flashing as though shooting tiny points of steel.

"I think, Captain Livingstone," continued Frontenac, "you have suffered your sensitiveness to get the better of your judgment. However, you stand in distinguished company, for Newton himself was by no means free of this weakness.

"The public heard about the palm-trees, though!" added Frontenac.

The captain laughed a sardonic, bitter laugh. "But there my story ended. Of course, in any event, it is only a question of time before others see what I saw and the world learns what I told *was* the truth. But what good will vindication do me when I am dead?"

A silence fell. It was broken by Frontenac, who arose and said:

"You will excuse me for a moment, Captain, while I return this trout to the freezer. Then your story."

"Are you going to freeze him again?"

"Again," said Frontenac. "This will be the third time."

"However, Mr. Frontenac, I believe, after all, everything has been for the best. Yes, yes, for you are the only man in all the world that can save her."

"There it is again!" said Darwin Frontenac, sinking into his chair. "Save *her*?"

"Yes, Mr. Frontenac, save her! In other words, *awake* her!

"And now, gentlemen," he added, "listen to the strangest tale that ever a man had to tell."

*"This is an awful place and terrible enough for us to have labored to it without the reward of priority."—Captain Scott's Journal.

(To be continued in next issue.)

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Readers Forum

(*Continued from page* 580)

Why not plant forests in such a way as to eliminate vast storm centers?

Why try to subdue nature instead of working in harmony with her; many times we seem to have subdued her, having her saddled and bridled, sitting firmly in the seat, then at the first touch of the spur, she bucks us off into chaos and we sit up wondering why?

Elsie Brierheath,
Spokane, Washington.

(We could add a few more whys and produce a purely idealistic state where misery and want are lacking and health and harmony reign supreme, but why be dreamers of the ages to come when we can dream of the immediate future and its manifold improvements? If many of us would cut down on dreaming and add a little action, the race as a whole and humanity in general would improve. Dreams are necessary for advancement, but action is necessary to make them come true. Nevertheless this world is a good old world in spite of its wars and strife and it is getting better and better every day.—Editor.)

SPIRITUALISM

Editor, *Science and Invention:*

I have been trying and hoping to find out just what spiritualism is, or if it is true or not through SCIENCE AND INVENTION. This magazine started out to get the facts about this spiritualism and I have been watching for the outcome for some time, but they have never printed the facts as they were supposed to have. Some people claim they have been bought out. Has someone bought them out?

Tolbert Hamilton.
Detroit, Mich.

(Science and Invention brands as imposters any who claim that this magazine or its agents have "bought out" any persons laying claim to producing spiritual phenomenon.

The awards of $11,000.00 paid wholly or in part for any or all phenomenon have not been paid because no one has come forward to prove the truth of the phenomenon. We are giving below the prize list of Mr. Joseph Rinn's $10,000.00 challenge.

$1000—To any person who will read what is on the pages of a book opened at random by me and placed open behind their back during the test.

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$1000—To any person who will cause a message to appear on the inside of slates joined together and provided by me, which during the test are to remain beneath the bosom of my shirt. If removed for examination new slates to be provided by me for further tests.

$1000—To any person who will prove telepathy or the power of two persons to communicate with each other by thought, after being blindfolded, their persons secured, and their ears and mouth filled with cotton by me.

$1000—To any person who will accurately describe something definite going on at a distance in a place selected by me, or who will predict in advance an event or calamity of such a definite nature that it would be impossible for such person to have any controlling power over or previous knowledge of the same; or who will produce a picture on a negative supplied by me while the same is in a locked safe and in a room provided by me.

$5000—To any person who after being searched and secured by me shall produce from their mouth or body what is called ectoplasm, and which shall shape itself into definite forms of hands or faces; or to any person who will prove under scientific conditions laid down by me that the spirits of the dead can communicate with the living.

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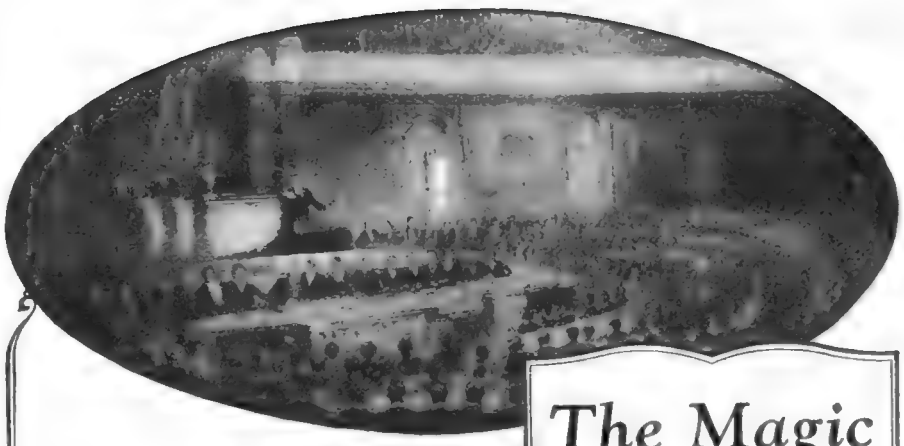
2.—Contestants must be willing to undergo tests on spiritistic phenomena or manifestations at the New York offices of SCIENCE AND INVENTION, *at 53 Park Place.*

3—The same committee of investigators that witnesses the tests of the medium will also witness the tests which SCIENCE AND INVENTION *will stage to duplicate the phenomena or manifestations in question.*

(*Continued on page* 611)



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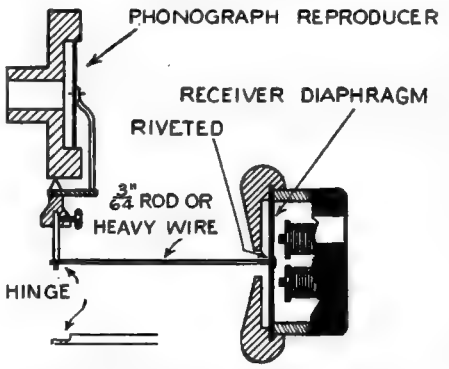
RADIO WRINKLES

EDITED BY
LEON L. ADELMAN, 2AFS
Assoc. Mem. I. R. E.

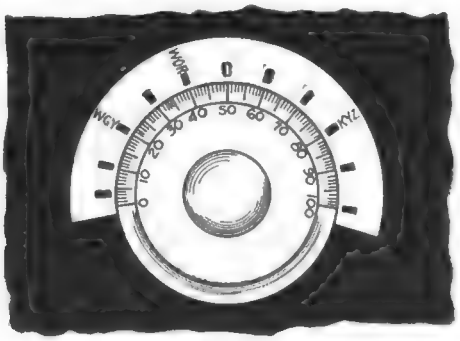
UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor, care of Science and Invention.

LOUD SPEAKER



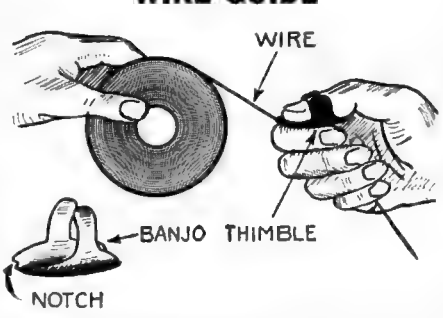
To use the phonograph reproducer as a loud speaker, a short length of aluminum wire is attached to it and fastened to the phone, as shown. Careful work brings good results.
—Philip Castanaro.

STATION RECORDER



A semi-circular piece of white celluloid is cemented to the back of the dial and a hole is punched at the position where each station is heard. A white marker is pasted on the panel, to facilitate tuning. —Henson Lasher.

WIRE GUIDE



Whenever, it becomes necessary to wind wire for an inductance or other purpose, exasperation and loss of control can be avoided by using a banjo thimble. —Fred Smeltzer.

(*Continued on page* 615)

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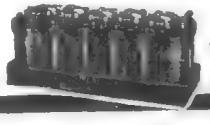

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4—Automatic writings will not be considered; such productions as these are considered sub-conscious phenomena.

5—Mediums must consent to present their offerings before the staff of SCIENCE AND INVENTION'S *investigation experts, general press representatives, and also Joseph Dunninger.*

6—It is understood that SCIENCE AND INVENTION *need not necessarily expose the methods they employ in duplicating the phenomena or manifestations. If the effect produced by the presentation of* SCIENCE AND INVENTION *duplicates the tests submitted by the medium, this is to be accepted as a sufficient reproduction. The details or methods employed by* SCIENCE AND INVENTION *need not be exposed, as it is understood that* SCIENCE AND INVENTION *reproduces all manifestations in a scientific manner, minus the spirits.*

7—An impartial committee will pass upon each test individually.

8—No exposes will be published in this magazine as to the methods employed by the practicing mediums contesting, as it is SCIENCE AND INVENTION'S *desire to expose nothing other than fraud spirit medium methods, as well as self deceptions.*

9—Methods employed by telepathists, mind readers, and mental artists, will not be accepted as evidence of spirit force.

10—Should preparation for duplicating a medium effect require a space of time for building or creating the necessary paraphernalia, such time as is necessary must be granted by the contestant.

11—This challenge expires on May 1st, 1924. In case of a tie, a duplicate prize will be awarded each contestant so tying.

12—In case the $1,000.00 has not been awarded by May 1st, 1924, SCIENCE & INVENTION *may, at its option, withdraw the offer of such prize.*

13—In case a prize is awarded to any contestant, SCIENCE & INVENTION *agrees to pay this amount in gold, within ten days after the findings of the disinterested committee.*

We desire to impress upon the minds of our readers that it is not the desire of SCIENCE AND INVENTION *to ridicule those who sincerely believe in so-called spiritistic manifestations. We desire to show that the communications and manifestations alleged by mediums and spiritists to emanate from the other world, prove nothing and can be duplicated by an accomplished magician. We hold that these manifestations are not sufficient to prove that the communications are supernatural or that the physical manifestations are the actions of the dead.*

Up to this time there has not been any scientific basis to prove conclusively by scientific means that there is a communication between the deceased and the living. Whenever scientific proof is given that such communication exists, SCIENCE AND INVENTION *will be the first to publish such a discovery.*

SCIENCE & INVENTION *extends the period of the contest for another year to May 1st, 1925, because the prize was not awarded to anyone on May 1st, 1924. There were but few competitors, each of whom were proved fraudulent.—Editor.)*

A COMPLIMENT!

Editor, *Science and Invention:*

It was when I was in the fifth grade of grammar school that I spent my "Sunday money" for a copy of the "Electrical Experimenter." (*The forerunner of* SCIENCE AND INVENTION.—*Ed.*) At that time I had a laboratory that consisted of a hammer, a few cents worth of nails, some wire and some worn out dry cells. I saved my pennies to buy and make things that I read about in the "Electrical Experimenter." I have read every issue since.

The magazine was a wonder then and it is now. It would be a hard and expensive thing to try and suit everybody with one magazine.

My favorite writers are H. Gernsback, C. Fezandié, Ray Cummings, articles by J. H. Kraus. Dr. Ernest Bade's manuscripts are great. I think the How-To-Make-It and Wrinkles, Formulas, and Recipes Departments are just right the way you have them.

Photographs and drawings are great, but some of your articles should have more text.

George H. Boesken
Cleveland, Ohio.

(An increase of text will be presented in all articles needing it.—Editor.)

CORRECTION NOTICE

In the August number of SCIENCE AND INVENTION under the Scientific Problems and Puzzles, edited by Ernest K. Chapin, the answer given to problem No. 2 was given as 20 pounds. This error crept in due to an oversight. The correct answer is 15 pounds. We are thankful to our many readers who called our attention to this fact.

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NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

GLASS STEERING WHEEL

(827)) Norman Vaness, Fort Wayne, Ind., requests our opinion of an automobile steering wheel made of pressed glass.

A. Our opinion of your "pressed" glass steering wheel is very poor indeed, and if you follow our suggestion you would forget about the idea immediately. What do you think would happen to that poor little steering wheel in the event of an accident? Not only would it cut the driver's hands immediately, but it might result in damage to other occupants of the machine.

COMMUTATORLESS D.C. GENERATORS

(828) Leo Vanderheyden, Buckingham, Iowa, asks if ideas can be sold. He also wants to know if he has invented a commutatorless D.C. generator and sends a diagram of the machine.

A. Ideas can be sold the same as patents, but the inventor has a certain amount of protection if he has a patent pending, which protection he does not hold if he merely sells his idea. In the latter case, one must deal with reliable concerns only. In the former, it does not make much difference, provided that your lawyer handles the sale of the patent. Contrary to your expectations you have not invented a commutatorless D.C. generator. The drawings of a type of generator similar to the one you submitted has been described time and time again, and although it gives a very low potential and direct current, and at the same time a very small amount of such current, it is quite impossible to increase the amount of current from such a device. If the machine is perfectly balanced and well designed, no direct current is produced. If there are faults in the iron and in the wiring, a very slight flow in either one direction or another is registered by a meter.

We do not advise applying for a patent on this system. It could not by any known means be employed in the elimination of static in radio receiving instruments.

SANDBLASTING GEARS

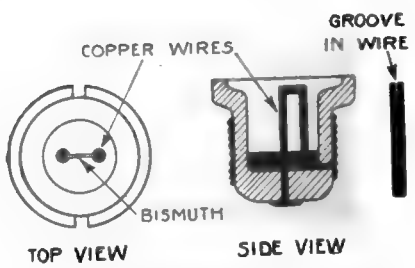
(829) Constantine H. Troy, of Elmira, N. Y., has solved a system for sandblasting gears which is, he believes, superior to the system now employed in the shop where he works. He asks our opinion.

A. Your idea for sandblasting gears is fairly good, but it will cost a great deal of money to put it across. Why not enter into some sort of a contract with your firm to give you a certain percentage of the returns should your system prove successful. The attempt is worth your while. Unfortunately, you can do very little with this idea if you merely secure a patent on the same. You will have to make a practical working model and give a positive demonstration of its superiority over other systems.

RENEWABLE FUSE

(830) Nick Raar, Grand Rapids, Mich., requests our opinion of a renewable fuse in which the link is clamped between spring clips.

A. We do not advise a patent on any renewable fuse, as the possibilities for the sale of the same are very slight unless you are in a position to manufacture and advertise the article.



A rather poor application of a renewable fuse.

Your fuse would not be passed by the Fire Underwriters, as the fuse link is not clamped in place, being merely held in position by means of poorly designed spring clips. You likewise show no protective covering for the fuse element.

It is not compulsory for an applicant securing a patent to have a model built, but a model gives the patent attorney a better conception of the device. You can take another fuse already found upon the market and convert it to your type for the purpose of supplying such a model.

SMOKING PIPE

(831) Paul W. Tietsche, Indianapolis, Ind., requests our opinion on a nicotine-absorbing pipe containing a blotting paper tube in the stem thereof.

A. With reference to the pipe which you have designed, we would advise that your idea, although at first glance seemingly fair, is really of no practical value because of the cost of manufacturing the same, and because of the uncleanliness in effecting the cleaning operation. It must be quite evident to you that when this blotting paper in the pipe becomes wet, it will swell, constricting the area through which the smoke passes. Then, on attempting to remove the same, the blotting paper will be torn to shreds, unless some kind of a ram rod is employed for its removal; and every time it is removed and a new one inserted, difficulty will be had in placing the new blotting paper tube in the pipe, due to the fact that the interior of the tube into which it passes, will remain moist. Contrary to your expectations, this pipe will not absorb nicotine. It will merely prevent the saliva from the mouth and the moisture from the tobacco from passing back into the mouth. In curved stems it would be impossible to use your arrangement. One company sells pipes in which a small receptacle is placed immediately under the bowl. This receptacle is to hold the saliva and prevent particles of tobacco from filtering into the pipe stem. The pipe is quite effective and also cheap to manufacture.

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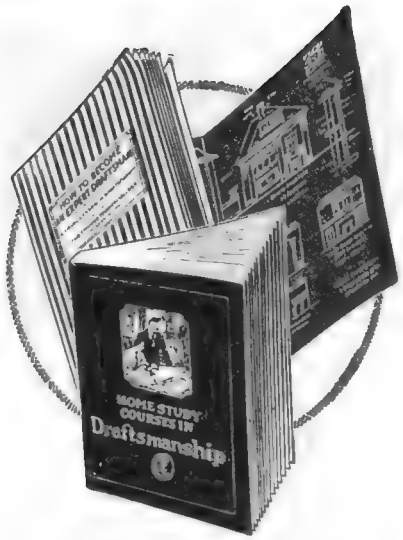

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AUTOMATIC ROAD MAP

(831) H. L. Triplett, New York City, submits a patent of an automatic road map to give exact locations of the car when on the road. The map is to be rolled on a spool and unrolls as the machine proceeds.

A. If your automatic road map for automobiles could be so arranged that an individual would take but one straight route to reach a certain town, the map would be of value. But what would happen if the individual came to a cross-road and decided to travel along that road, or what would occur if the individual came to a detour? You have evidently not taken this into consideration at all.

Then the difficulty would be to have a sufficient number of these spools to cover every road throughout the United States. This is, in our opinion, an almost impassable barrier. For this reason we do not believe that your invention would ever be of practical value. If a concern with large financial backing could develop a system of this kind, there is a possibility of obtaining limited profits.

HONEYCOMB COIL WINDER

(832) E. J. Tasset, Bellefont, Kansas, submitted a drawing of a honeycomb-coil former for winding coils at home. This system was good and he was so advised, but it was too expensive. He now sends a drawing of a substitute for the first one.

A. The difficulty with your coil winding machine at the present time is that it will not wind a honeycomb coil. It will merely wind a coil with an elliptical form. You will note that the ratchet arm moves back and forth at a fixed rate relative to the coil form-holders. This fixed speed will produce a bank coil, one turn lying on the other, and when the coil is finished and removed from the holder, the roll of wire will be in the shape of an ellipse. This system is far inferior to your previous one, even though it is considerably simpler

We would suggest that in developing these systems, you build a small model out of cardboard or of small parts, in order to demonstrate to yourself the working of the devices.

FURNACE REGULATOR

(833) Constantine Troy, Elmira, N. Y., submits a drawing of a home furnace regulator, employing an odd type of thermostat, motor or solenoids and relays. He requests our opinion on the device.

A. Your suggestion for a furnace regulator is without a doubt of some value, but the value is so slight that we would hesitate at advising you to apply for a patent on the particular arrangement of the parts. Where perhaps one concern may be willing to install a regulator such as you describe, there are hundreds who would not do so, and we believe that you will be unable to successfully market this device.

Of course we can not claim to be infallible in our decisions, but previous experience has taught us that there is very little possibility of effecting a sale on a furnace regulator employing pyrometer principles. Regulators actuated by relays and either solenoids or motors are not suitable for home use. We do not suggest that you apply for a patent on this device.

NON-BREAKABLE GLASS

(834) Norman Van Ness, Fort Wayne, Ind., claims to have a formula for unbreakable glass made in part with transparent rubber. He asks if anything similar is on the market.

A. Unshatterable glass has been on the market for a great many years, and there are about twelve to fifteen concerns making the same today. This consists of two-ply glass with a layer of celluloid between, or in some cases of three-ply glass with two layers of celluloid between. The glass and celluloid are joined together under great pressure.

If you have a better formula for unbreakable glass, or if you have a formula for malleable glass, you may rest assured that it will be looked upon favorably.

COMBINATION AUTO GAUGE

(835) Henry Uzarantz, Rutherford, N. J., claims to have designed a simple and effective gasoline gauge which records the amount of gasoline in the tank and the amount of oil in the engine, and gives the number of miles per gallon at all times, as well as tells condition of radiator, water, etc. He asks our opinion of his system.

A. If your device does all you claim it will do and has no mechanical defects, applications for a patent would certainly be advisable. We believe, however, that you have only brought forth the interesting feature of your invention, not saying a word about the defects or the cost of manufacture.

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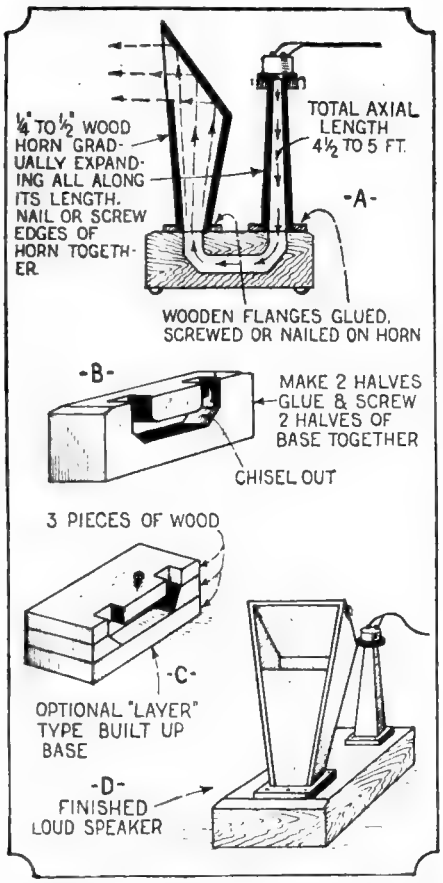
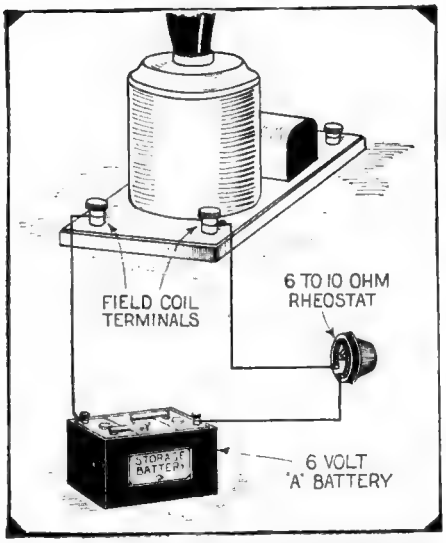
LOUD SPEAKER HORN


¼" TO ½" WOOD HORN GRADUALLY EXPANDING ALL ALONG ITS LENGTH. NAIL OR SCREW EDGES OF HORN TOGETHER
TOTAL AXIAL LENGTH 4½ TO 5 FT.
-A-
WOODEN FLANGES GLUED, SCREWED OR NAILED ON HORN
-B-
MAKE 2 HALVES GLUE & SCREW 2 HALVES OF BASE TOGETHER
CHISEL OUT
3 PIECES OF WOOD
-C-
OPTIONAL "LAYER" TYPE BUILT UP BASE
-D-
FINISHED LOUD SPEAKER

Herewith is a sketch of a home-made loud talker built entirely of wood; the total length of the sound chamber along its axis is to be about five feet. Recent experiments in acoustics have shown that the amplifying horn should be four and a half to five feet to give best results. This design permits the using of this very desirable long amplifying chamber with a minimum of space requirement. A suitable clamping strap should be provided to fasten the loud speaker unit on the small end of the horn.

LOUD SPEAKER VOLUME CONTROLLER



The sound volume of any old type Magnavox or other similar loud speaker can easily be regulated by placing a rheostat in series with the field coil posts and the 6 volt "A" battery. The rheostat should have a resistance of at least six ohms and preferably ten ohms or more. This regulates the current in the field coils, and consequently their magnetic strength and the amount of motion of the moving coil for a given signal. With a rheostat of 10 ohms resistance, the 1 ampere field-current can be cut down to a minimum of .37 ampere.

—Harry R. Lubcke, Reporter No. 1015.

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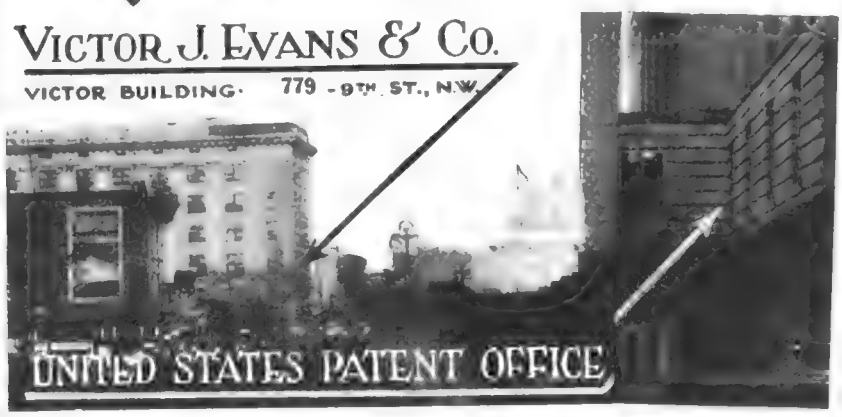

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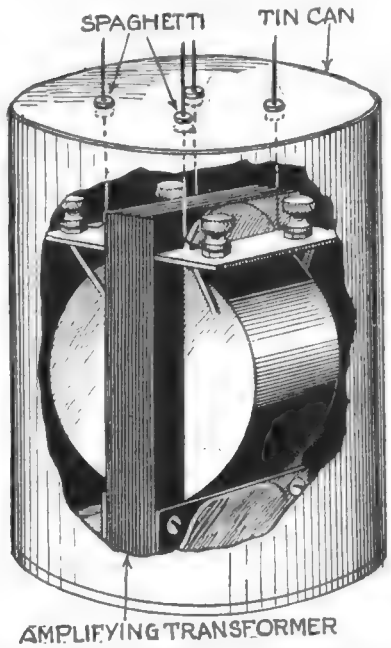
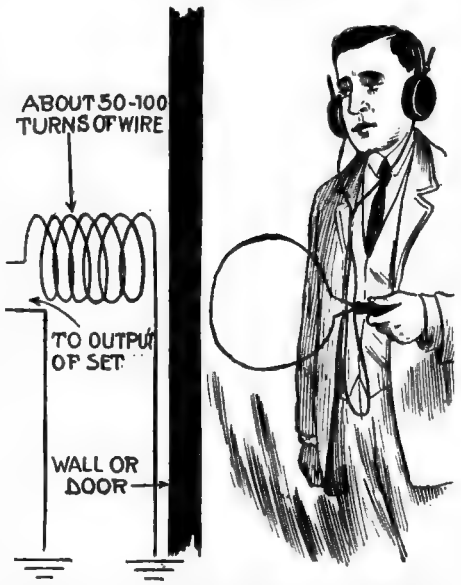
TRANSFORMER SHIELD



To approach perfection in the assembly of a two step audio frequency amplifier requires that a minimum of interaction occurs between transformers. A tin can serves admirably for preventing interaction. —Fred Ebel.

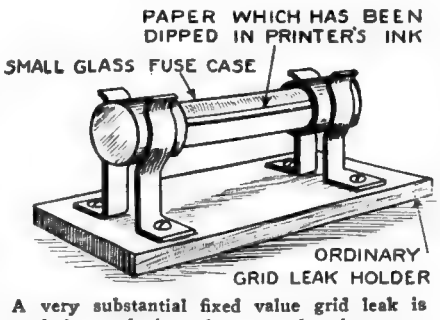
MYSTIC MUSIC



Loads of fun can be had by having several hidden coils of wire connected in series and placed about the house. The uninitiated betray great amazement when trying to find the source of music while exploring with a loop of wire connected to the phone terminals.

—Charles Rehm, Reporter No. 3932.

GRID LEAK



A very substantial fixed value grid leak is made by employing a burnt out fuse from your auto. A piece of paper ⅛ inch wide is dipped in India ink and allowed to dry thoroughly and then inserted.

—A. W. Partington, Reporter No. 10316.

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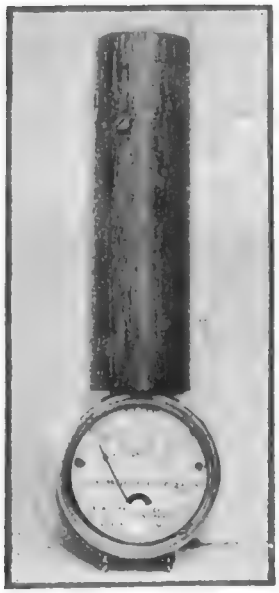
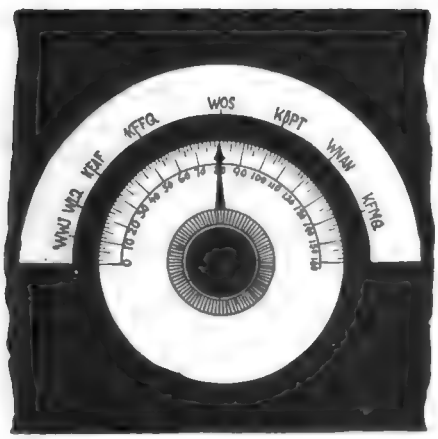
HANDY TESTER



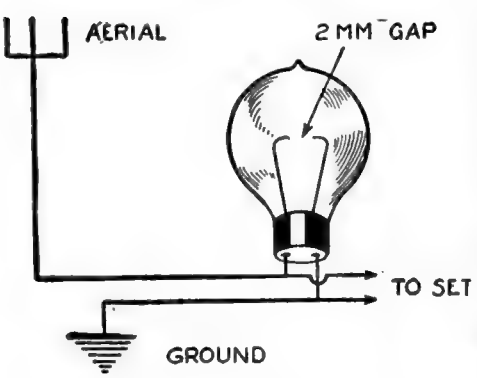
By providing a volt-ammeter with a wooden handle, an instrument already very convenient is made more so and is adaptable to a greater degree of usefulness. (Author please send name and address.—Ed.)

INDICATOR

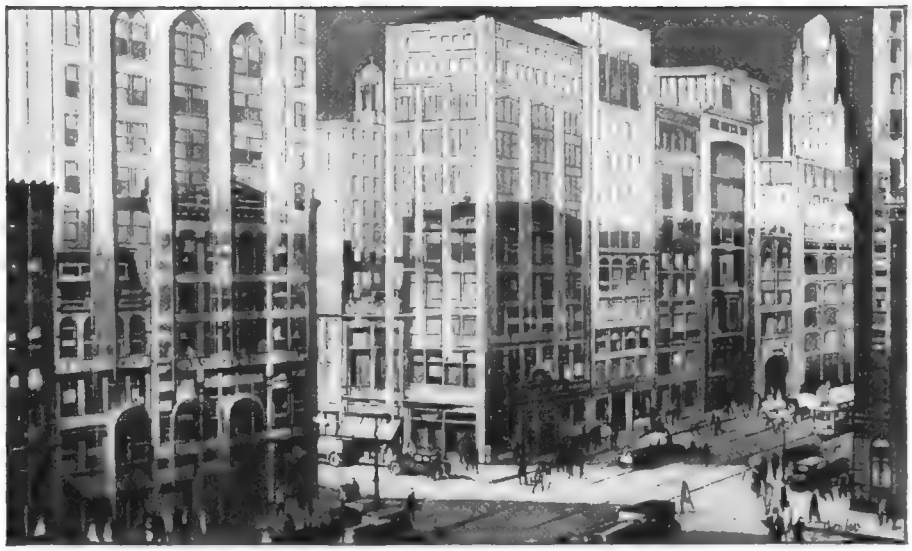


By pasting a piece of heavy white paper or celluloid as shown, another scheme for permanently recording stations is accomplished. A line acting as indicator is drawn in the middle of the dial and the name of the station heard is written on the white paper or celluloid.
—Harold Menges.

LIGHTNING ARRESTER



As a means of safe-guarding a radio installation against lightning, a serviceable arrester is found in the use of a miniature burnt out auto or flashlight bulb. —W. B. Box.



To-morrow's Telephones

So vital a factor has the telephone become in American life that the demand for it would undoubtedly grow even without increases in population. New businesses are founded; others expand. New homes are established in town and city, in suburban dwellings and apartment houses.

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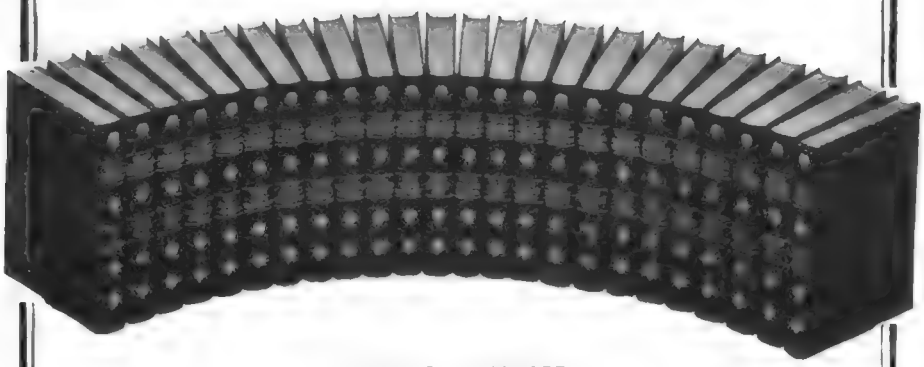

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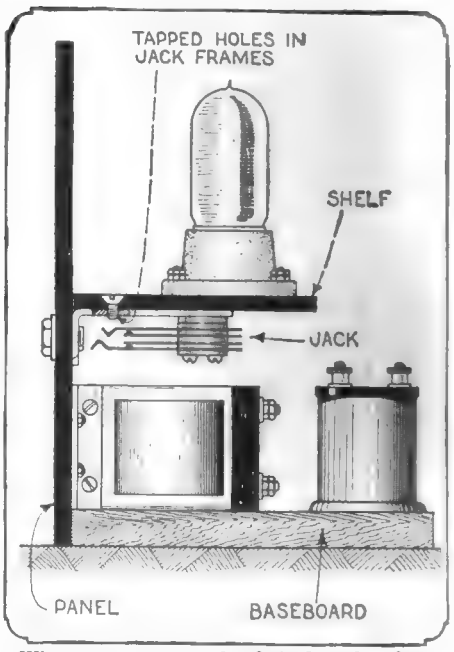
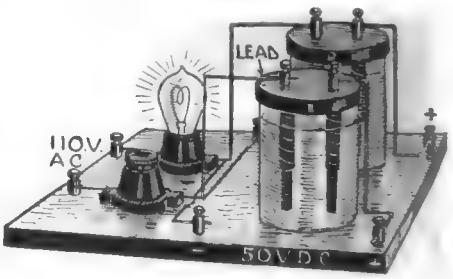
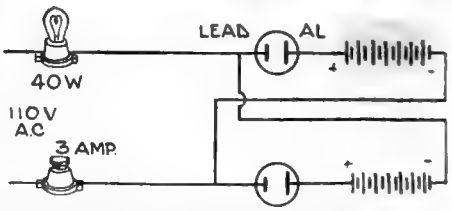


Where compactness is desired and where space is at a premium advantage is taken of the mechanical features of the instruments. A series of two or three jacks will form a perfect support for a tube shelf, while a transformer obviates the necessity of extra brackets and expense.

—Joseph F. Odenbach, Reporter No. 10.

ELECTROLYTIC CHARGER

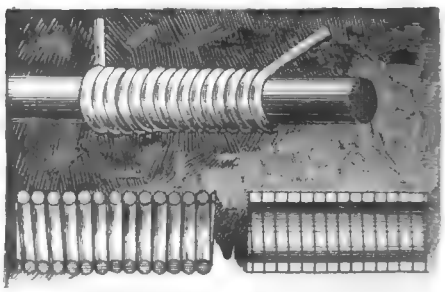




Two fruit jars containing a concentrated solution of borax, into which are immersed a lead and an aluminum rod, form an excellent B battery charger. After assembly, the plates are "formed" by connecting each set of terminals together and turning on the current for half an hour. Two sets of 22½ volt or 45 volt units can be charged at one time.

—C. F. Tuma.

NEUTRODON



By winding a length of bus bar around a pencil and then filling in the interstices with solder, a real good sliding tube for a neutralizing condenser is made.

—William M. Hanneman.

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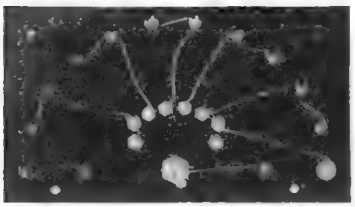
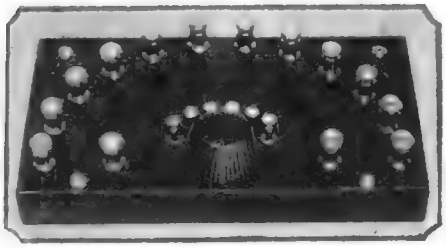
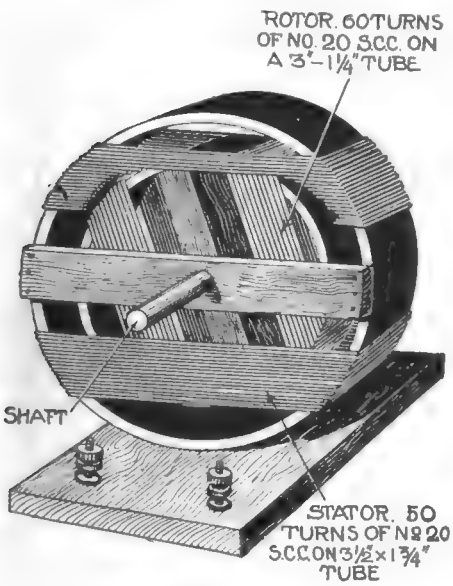
PHONE BLOCK





A piece of bakelite, 14 binding posts, a switch lever, 6 contact points and two switch stops when assembled as is shown, form a neat connection block. (Author kindly send name and address.—Ed.)

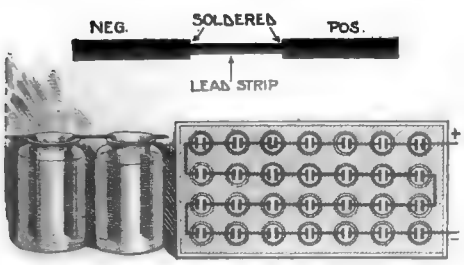
VARIOMETER-COUPLER



For a cheap instrument the above is hard to beat. Cardboard or fibre tubes are wound with number 20 S.C.C. wire and connected either as a variometer or variocoupler, the whole being mounted on a wooden base. Flexible leads are used to connect the rotor.

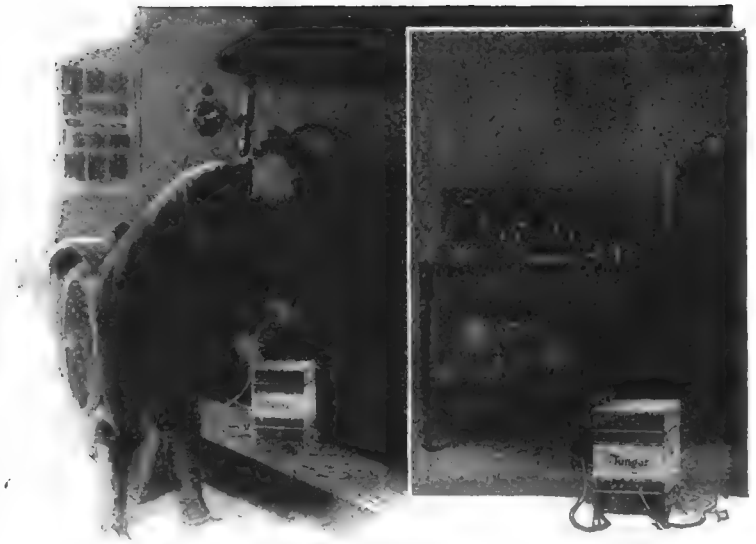
—Arthur A. Blumenfeld.

STORAGE B BATTERY



Using 44 small jars from a five and ten cent store, a 90 volt storage battery that will last a long time on one charge, can be made by cutting up a dozen each of positive and negative plates obtained at the battery station. These are soldered together with a strip of lead between them. The acid should be obtained at the same place and is known as 1200.

—E. J. Roy.



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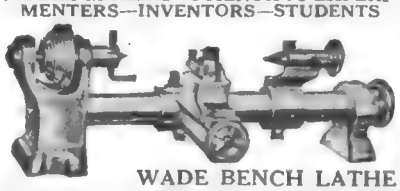

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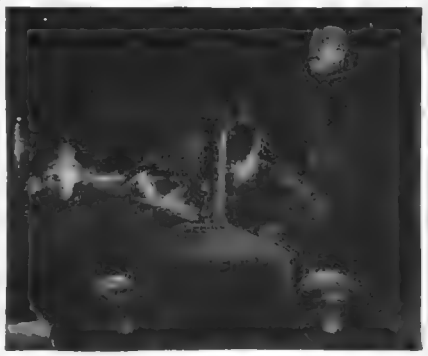

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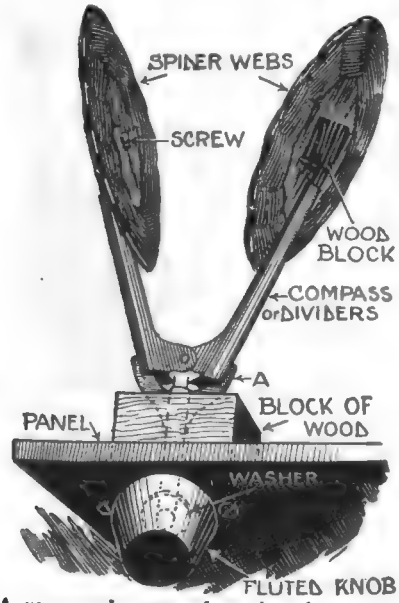

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—T. Asplund.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page* 557)

joke. They do not realize that the evolution of sex is one of the most marvelous achievements of nature; that it is sex which has produced the higher animals and raised man to his present supreme position. It is sex that laid the base for social life and made civilization possible. The primitive animals and plants that possess no sex have been left far behind in the race. And yet, strange to say, there now seems to be a reaction. Among the highly socialized communities of animals, such as the ants and the bees, there has been evolved a sexless form, neuters or workers as they are called. The ants show a transition stage. There are a number of males and females in the ant-hill, but the majority are neuters, either workers or soldiers. In the bees, there is only one real female in the hive,—the queen; the workers are undeveloped females. The drones or males are kept on tolerance and killed off at the approach of winter. Only one drone is really necessary, but it is desirable to keep a number, so that when the queen leaves the hive seeking a lover, she shall not have far to travel before she finds him. Only one drone out of the thousands in the hive is made happy, and he pays for the privilege with his life, for he dies in the act of mating.

"Now I am convinced that in this microscopic world we have before us, the conditions are very much the same as with bees. I am convinced these smaller undeveloped women are really neuters, and that the queen is the only true female. In fact, if I am not mistaken, she lays eggs like a bee instead of bringing forth her young alive. It must be so, for as you will see, her house contains cells of two sizes exactly as is the case with bees."

"Do bees make cells of two different sizes?"

"Yes, the drone cells and the worker cells. In fact they make a third and still larger size when they want a new queen. The bees are ahead of us in one way, they have the power of determining which of

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their young shall be males and which shall be females."

"Is it possible?"

"The fact is undeniable and for years the true explanation eluded our entomologists. But at last the solution has been found."

"What is the explanation?"

"It was a pretty problem," continued the doctor. "Of course it has long been known that the workers constructed two sizes of cells, and that the eggs laid in the large cells always hatched out as drones, while the eggs in the small cells hatched out as workers. But there seemed three possible explanations: First—The queen bee might possess the power of laying a male or female egg at will, and was always careful to lay a male egg in a drone-cell, and a female egg in a worker-cell. Second—The queen might know in some way whether her next egg was to be male or female, and so be able to lay it in the right cell. Third—The eggs might all be alike, but the sex be determined by the food furnished by the workers to the growing larvae. As a matter of fact, none of these three theories was the correct one, though the true explanation was only discovered comparatively recently, by careful observations under the microscope."

"And what is the secret?"

"Simply this. The queen bee has in her abdomen what is known as a sperm-sac. During her wedding-flight, this sack is filled full of sperm by the drone, who then dies. The queen-bee then returns to the hive with this small sackfull of sperm, and this must serve her afterwards to fertilize her eggs during the remainder of her life—that is to say for several years."

"But that doesn't explain the sex of the young."

"Yes, it does. When the queen lays an egg in a small cell, that is to say a worker cell, the tip of her abdomen is compressed, and a drop of sperm is forced out of the sperm-sac and fertilizes the egg. When, on the other hand, the queen lays an egg in a large cell,—a drone-cell,—her abdomen is not compressed and the egg laid is unfertilized. The fertilized eggs produce females, the unfertilized eggs always produce males. This explains, too, how it is that when, as occasionally happens, a worker-bee develops sufficiently to lay eggs, these produce drones, since the eggs have not been fertilized."

"But doctor, do you mean to tell me that you consider it an advantage for ants and bees to have a sex of neuters?"

"Not only is it advantageous for ants and bees Silas, but it seems to be advantageous for mankind as well. We, too, live in large social communities, and we, too, are rapidly evolving a race of neuters. You will hear a great deal of bosh about 'race-suicide.' As a matter of fact, evolution, as a rule, is inevitably accompanied by a diminution in the birth-rate. Animals or plants low in the scale produce eggs or seeds in countless numbers. A cherry tree will produce about a million cherries during its life-time, each capable of growing into a new tree. A salmon, likewise will lay a million eggs, each of which could produce a salmon—Competition kills off all but one of the offspring on an average, so that the total number of cherry trees or salmon remains about the same. Among the higher animals there are fewer births but also fewer deaths—in other words there is less waste. You have heard of the law of Malthus, the law that led Darwin to his theory of Natural Selection. According to Malthus, population in a new country doubles every sixteen years, hence, unless there were some natural check, there would soon be no room for the new men and women. But, as population increases, the birth-rate diminishes, until, as in France, a point is reached where the birth-rate and death-rate become equal, and

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population remains stationery. Many men and women marry late or never marry at all, and the couples produce few children or are even completely sterile. In a word man too, has already evolved a third sex—a sex of neuters.

"But all this is beside the point. Here are these microscopic men and women with neuters distinct in appearance from either males or females. Here, too are the cells in which the young grow from the egg. Watch! Here are some nurses attending to a baby that has just emerged from his cell. We're in luck, because the number of births is very few, these people seeming to have a life as long as our own. Hence only a small annual birth-rate is required to keep up the population."

"You say these beings have a spoken language?"

"Yes, and in that too, they differ from bees."

"How do you know that bees haven't a spoken language?"

"Pierre Huber proved that by a clever and conclusive experiment. You are perhaps aware that bees have only one queen in a hive. If anything happens to her, however, they at once set to work hatching a new one from a worker egg. The way they do this is to make one large cell so as to give the larva plenty of space in which to develop completely. Huber took advantage of this fact. He opened a hive of bees and placed a fine-meshed wire netting down the centre, thus confining half the bees on one side of the hive, and half on the other.

"Instantly the whole hive was in commotion; but after a few minutes everything returned to its normal condition. The bees on the side where there was no queen had evidently learned in some way from their friends that the queen was safe.

"Then Pierre Huber opened the hive again and placed a second netting alongside the first, parallel to it, but an inch away. If the bees communicated with each other by sounds, a distance of an inch should be no obstacle. If, however, they communicated by touching each other, the partition would prevent them from giving their friends news that the quee.. was safe.

"The experiment proved the correctness of the theory. The same commotion as before started in the hive. But on the side where the queen was, the disturbance soon subsided as the bees learned that the queen was safe. On the other side of the hive, however, the news was not received, for these bees at once set about rearing a new queen. Hence it was evident that the language of bees is one of touch and not of sound."

"You say you can understand the speech of your microscopic men and women? What do they speak about?"

"They seem to be very primitive. Their language is simple, like that of a savage, and their sentences are short consisting of only a few words. They seem to have no art, literature or science, and their industries are undeveloped. Their houses are transparent being made of a sort of wax-like substance. They make their own clothing but it consists of the skins of animals and is little more than a breech-cloth. They feed on flesh and on vegetables and also prepare a kind of honey which they store up. They make a cordage of vegetable fibres, as you will see if you carefully examine the hammock in which Ionia is lying. They even have horses or shall I call them unicorns? See! There is a neuter riding one now! Notice how the horn of the unicorn is gracefully twisted. Evidently this animal evolved from the dwarf horses of ancient times."

"Have these creatures no weapons?"

"Yes, they have bows, arrows and lances. Wait till I turn the film and you can see a mammoth hunt. There! See how these tiny creatures, with their primitive weapons, bravely attack this monster, which though

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microscopic to us, is gigantic to them. See how the unicorns help in the attack. It is really a wonderful sight!"

"Do these creatures use fire?"

"Not to my knowledge. They seem to have stood still at their primitive age while we were making progress. I can only explain it on the theory that their small size gave them immunity from their enemies and made it easier for them to procure food. It is the struggle for existence that produces progress and evolution. Where there are no competitors to fight against, the life of ease renders people indolent, and retrogression sets in. These people in their microscopic world seem to have few enemies—and yet . . ." Doctor Hackenshaw paused.

"And yet?" repeated Silas, interrogatively, seeing that the doctor was holding something back.

"And yet there is one part of their country which they seem to shun, and with good reason, for it seems to contain monsters of the most frightful kind—microscopic to us, of course, but gigantic to these little people. You will understand better, however, if I change the film."

Silas waited impatiently while the doctor, consulting a memorandum he had made, carefully turned several micrometer screens on his instruments. Even then he was obliged to use a finder, similar to the finders used with large telescopes, before he could find the exact spot he was seeking. "There, Silas," said he, "now look!"

The reporter gazed in surprise. There, amid a luxuriant tropical vegetation of palm-like cycads, tree-ferns and tropical cone-bearing trees, there was an enormous brontosaurus quietly grazing if we may use the word "grazing" where no grass or flowering plant grew.

"You see, Silas," explained Doctor Hackensaw, "we have before us a Mezozoic landscape with its Mezozoic animals and plants. Grasses and flowers were unknown at that period of the world's history, and the reptiles were the highest animals evolved. In some way the creatures have survived in this reduced form, but have not progressed. But look, quick! See that ugly carnivorous dinosaur! That's a tyrannosaurus I'll bet! What a frightful monster! See him pounce on the brontosaurus, though the latter is many times his size! Now he's sucking its life-blood! Whew! I can't stand this, I must turn the instrument in some other direction—I want another look at Ionia."

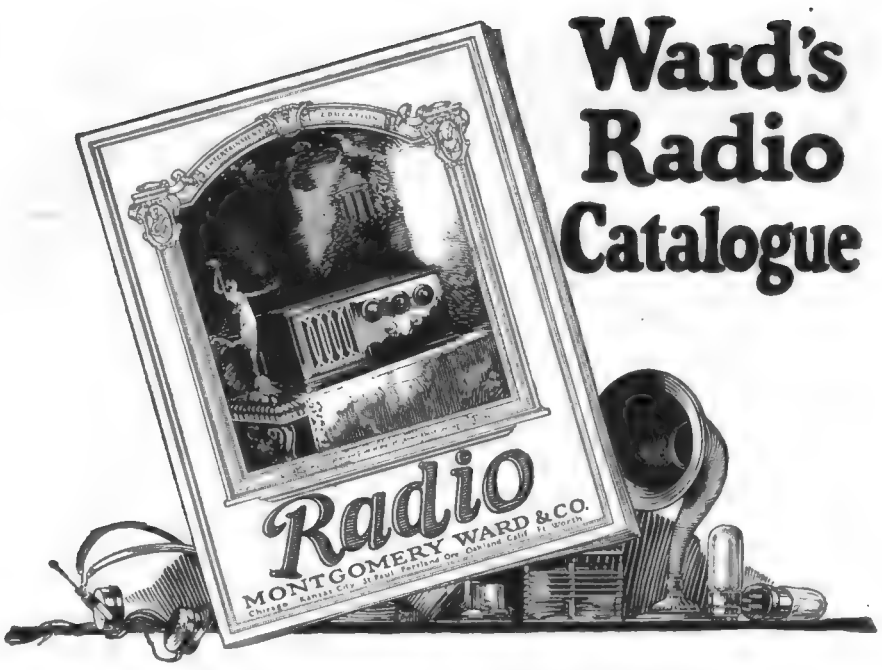
Again the doctor shifted the thumb screw, and had soon brought the beautiful queen again upon the screen. But now she was out for a gallop on her unicorn through the shady woods. But horror of horror! Another flesh eating dinosaur asleep in the forest was awakened by the tramp of the unicorn's hoofs, and with one pounce had knocked over the horse and seized the fair rider in his reptilian jaws.

"Quick, doctor, quick, for mercy's sake, save her!" cried Silas.

"But what can I do, I'm perfectly helpless!" cried the doctor. "I can no more interfere than I could if this were taking place on the moon!"

And then an idea came to him. By an ingenious arrangement the last microscope and the first one were in the same room, side by side. This was for the purpose of enabling the doctor to shift the object glass at will. There happened to be a small bottle of sulphuric acid on a table. Seizing this, the doctor quickly poured some of the powerful acid into the object glasses. Instantly the whole picture vanished—woods, city reptiles and Ionia with them. To the people on the microscopic world it was as if some cataclysm had suddenly blotted them out of existence.

"I'm sorry I had to do it, Silas," re-



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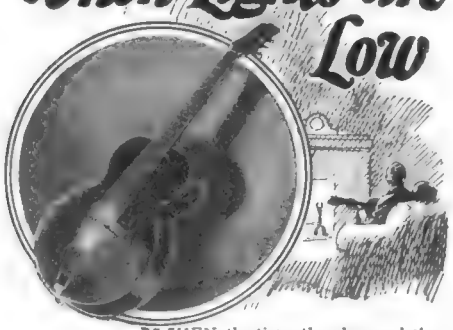

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marked Doctor Hackensaw, almost sobbing, "but I couldn't stand by and see Ionia torn to pieces by that cruel monster. It's a pity to have had to destroy this whole world of interesting creatures, but curiously enough I had no power to change anything in their world without destroying it completely. It is much the same in our human world. One man has very little power in improving it, but his powers of destruction are practically unlimited!"

The Heavens In October

By ISABEL M. LEWIS, M. A.

(*Continued from page 566*)

flows toward the south and southeast, as mentioned already.

In the northeast this month appear the constellations representing the royal group, Cepheus, king of Ethiopia, his beautiful queen Cassiopeia, and Andromeda their daughter who was chained to the rocks to be devoured by the huge sea-monster Cetus, now rising above the eastern horizon. Perseus, the hero, who came to the rescue of the maiden on his winged horse Pegasus, will be found next to Andromeda on the northeast and directly in the path of the Milky Way. In his hand he holds, as the legend tells us, the head of the snaky-locked Gorgon, Medusa in which appears Algol, the variable star that represents the baleful, winking eye of the demon. Every third day this star drops suddenly from the second to the third magnitude and recovers its former brightness within a period of a few hours. This is caused by the periodic eclipse of the brighter star by a dark companion in close and rapid revolution around it.

Alpha, the brightest star in Perseus, is in the midst of a brilliant field of stars in the Milky Way that is one of the finest in the heavens to view with a field glass or small telescope.

Not far away in Andromeda, about fifteen degrees due south of the star Alpha in Cassiopeia, which follows next after the leader or most westerly of the stars in the west, we find one of the most interesting objects in the heavens, the Great Andromeda Nebula. Even without the aid of the telescope we will be able to detect this object as a faint, luminous cloud. It covers an area over three times as great as that covered by the full moon and as it is at least more distant than the nearest stars the actual size of this object must be tremendous. Some believe that it represents an external universe on a scale comparable to our Milky Way system of stars which contains hundreds of millions of stars and many great gaseous nebulas. If so, its distance must be reckoned in hundreds of thousands of light years.

It is hardly safe to venture, at present, an estimate of the distance of the Great Andromeda nebula, for astronomers are not agreed either as to the nature of this interesting object or as to its distance. According to an estimate recently made by the English mathematician and astronomer, Jeans, it is at a distance of approximately 4,000 light years. Various estimates of its distance range from a few hundred light years to over a million. It is the largest and brightest of the spiral nebulae that have been the subject of so much discussion in recent years, and it is known to be approaching the earth at a velocity of 200 miles per second. There is also evidence that it is rotating. Many of us are doubtless already familiar with this beautiful object through the photographs of it that have been taken with the Mt. Wilson 100-inch reflector and other great telescopes.

Next to Andromeda on the southwest is one of the most conspicuous configurations

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in the heavens, as familiar to seasoned stargazers as the Big Dipper or the W of Cassiopeia. This is the Great Square in Pegasus, with the star Alpha in Andromeda marking its northeastern corner. We always associate this group of four stars in the form of a huge, nearly perfect square with the month of October and take it as one of the signs that the fall is here. Another sign of fall is the appearance of the beautiful Fomalhaut from the southland over in the southeastern part of the sky.

This month we will look in vain for our friends of the past summer, the planets Jupiter and Saturn, which are now too close to the sun to be seen. Venus passed long ago to the morning sky where she now greets the early riser in all her splendor. Mars alone remains of all the bright planets visible in the evening hours and Mars is now speeding away from the earth and rapidly losing the unusual glory and brilliancy that marked its close approach to the earth in August and made it for a time the most interesting object in the heavens. On the fifteenth of this month its distance from the earth has increased to nearly fifty-one million miles as compared with a distance of less than thirty-five million miles at opposition in August.

Radio Broadcast

Revised and corrected to date.

First Group of Figures Indicate the Power in Watts in the Antenna of the Transmitting Station. The Second Group Gives the Wave-Length.

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—270
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Newhouse Hotel,	Salt Lake City, Utah	100—360
KDYM	Savoy Theatre,	San Diego, Cal.	100—280
KDYQ	Oregon Institute of Technology,	Portland, Ore.	50—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZE	Rhodes Department Store,	Seattle, Wash	100—270
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	500—278
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywood, Calif.	200—280
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAW	The Radio Den (W. B. Ashford),	Santa Ana, Calif.	10—280
KFAY	Virgin's Radio Service (W. J. Virgin),	Medford, Ore.	50—283
KFBB	F. A. Buttrey & Co.,	Havre, Mont.	50—360
KFBC	W. K. Azbill,	San Diego, Calif.	5—278
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	50—242
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	100—283
KFBL	Leese Bros.,	Everett, Wash.	15—224
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	10—280
KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—238
KFCF	Frank A. Moore,	Walla Walla, Wash.	100—360
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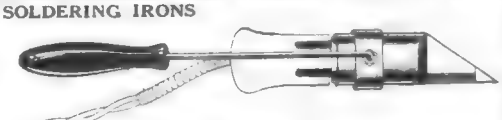

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KFEC	Meier & Frank Co.,	Portland, Ore.	50—248
KFEL	Winner Radio Corp.,	Denver, Colo.	50—254
KFEQ	J. L. Scroggin,	Oak, Neb.	100—268
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	10—231
KFEV	Felix-Thompson Radio Shop,	Casper, Wyo.	50—263
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15 PARK ROW NEW YORK

Call Letters	Name	Location	Power & Wave Length
KFLA	Abner R. Willson, Butte, Mont.		5—283
KFLB	Signal Electric Mfg. Co., Menominee, Mich.		50—248
KFLD	Paul E. Greenlaw, Franklinton, La.		10—234
KFLE	National Educational Service, Denver, Colo.		25—268
KFLQ	Bizzell Radio Shop, Little Rock, Ark.		20—261
KFLR	University of New Mexico, Albuquerque, N. M.		100—254
KFLU	Rio Grande Radio Supply House, San Benito, Texas		100—236
KFLV	A. T. Frykman, Rockford, Ill.		100—229
KFLW	Missoula Electric Supply Co., Missoula, Mont.		5—234
KFLX	George R. Clough, Galveston, Texas		10—240
KFLZ	Atlantic Automobile Co., Atlantic, Iowa		100—273
KFMB	Christian Churches of Little Rock, Little Rock, Ark.		10—254
KFMQ	University of Arkansas, Fayetteville, Ark.		100—263
KFMR	Morningside College, Sioux City, Iowa		10—261
KFMT	George W. Youug, Minneapolis, Minn.		5—231
KFMW	M. G. Sateren, Houghton, Mich.		50—266
KFMX	Carleton College, Northfield, Minn.		500—283
KFNF	Henry Field Seed Co., Shenandoah, Iowa		500—266
KFNG	Wooten's Radio Shop, Coldwater, Miss.		10—254
KFNJ	Warrensburg Electric Shop, Warrensburg, Mo.		50—234
KFNL	Radio Broadcast Association, Paso Robles, Calif.		10—240
KFNV	L. A. Drake, Santa Rosa, Calif.		5—234
KFNY	Montana Phonograph Co., Helena, Mont.		5—261
KFNZ	Royal Radio Co., Burlingame, Calif.		10—231
KFOA	Rhodes Dept. Store, Seattle, Wash.		500—455
KFOC	First Christian Church, Whittier, Calif.		100—236
KFOD	The Radio Shop, Wallace, Idaho		10—224
KFOJ	Moberly High School Radio Club, Moberly, Mo.		5—246
KFOL	Leslie M. Schafbuch, Marengo, Iowa		10—234
KFON	Echophone Radio Shop, Long Beach, Calif.		100—234
KFOO	Latter Day Saints University, Salt Lake City, Utah		10—261
KFOQ	Ora W. Chancellow, Galveston, Texas		50—240
KFOR	David City Tire & Electric Co., David City, Neb.		20—226
KFOT	College Hill Radio Club, Wichita, Kan.		50—231
KFOU	Mommel Manufacturing Co., Richmond, Calif.		100—254
KFOX	Technical High School (Board of Education), Omaha, Neb.		100—248
KFOY	Beacon Radio Service, St. Paul, Minn.		50—226
KFOZ	Leon Hudson Real Estate Co., Fort Smith, Ark.		20—233
KFPB	Edwin J. Brown, Seattle, Wash.		15—224
KFPG	Garretson & Dennis, Los Angeles, Calif.		100—238
KFPH	Howard C. Mailander, Salt Lake City, Utah		50—242
KFPL	C. C. Baxter, Dublin, Texas		15—242
KFPN	Missouri National Guard, Headquarters Company, 70th Infantry Brigade, Jefferson City, Mo.		10—242
KFPM	New Furniture Co., Greenville, Texas		10—242
KFPO	Colorado National Guard, Forty-fifth Division Tank Co., Denver, Colo.		500—231
KFPP	G. & G. Radio & Electric Shop, Olympia, Wash.		20—236
KFPR	Los Angeles County Forestry Department, Los Angeles, Cal.		500—231
KFPS	Carter A. Ross Motor Service Co., Casper, Wyo.		10—242
KFPT	Cane & Johnson, Salt Lake City, Utah		500—268
KFPV	Heintz & Kohlmoos, San Francisco, Calif.		50—236
KFPW	St. Johns Church, Carterville, Mo.		10—268
KFPX	First Presbyterian Church, Pine Bluff, Ark.		100—242
KFPY	Symons Investment Co., Spokane, Wash.		100—283
KFQA	The Principia, St. Louis, Mo.		50—261
KFQB	Searchlight Publishing Co., Fort Worth, Texas		100—254
KFQC	Kidd Brothers Radio Shop, Taft, Calif.		100—227
KFQD	Chovin Supply Co., Anchorage, Alaska		100—280
KFQE	Dickenson-Henry Radio Laboratories, Colorado Springs, Colo.		5—224
KFQF	Donald A. Boult, Minneapolis, Minn.		10—224

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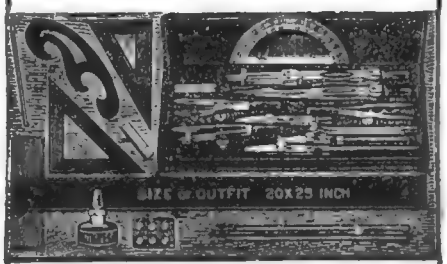

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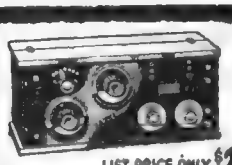
Call Letters	Name	Location	Power & Wave Length
KFQG	Southern California Radio Association,	Los Angeles, Calif., Armory, Exposition Park....	100—226
KFQH	Albert Sherman,	Hillsbourgh, Calif.	50—231
KFQI	Thomas H. Ince Corp.,	Culver City, Calif.	100—234
KFQJ	Harbour-Longmire Co.,	Oklahoma,, Okla.	50—236
KFQK	Democrat Leader,	Fayette, Mo.	10—236
KFQL	Oklahoma Free State Fair Association,	Muskogee, Okla...	10—252
KFQM	Texas Highway Bulletin,	Austin, Texas	100—268
KFQN	Third Baptist Church,	Portland, Oregon	5—283
KFQO	Meier Radio Shop,	Russell, Kansas	10—261
KFQP	George S. Carson, Jr.,	Iowa City, Iowa	10—224
KFQR	Walter L. Ellis,	Oklahoma, Okla.	10—250
KFQS	Dickenson-Henry Radio Labs.,	Manitou, Colo.	10—246
KFQT	Texas National Guard, Thirty-sixth Signal Co.,	Denison, Texas	10—252
KFQU	W. Riker,	Holy City, Calif...	100—234
KFQV	Omaha Grain Exchange,	Omaha, Neb.	100—231
KFQW	C. F. Knierim Photo Radio & Electric Shop,	North Bend, Wash.	50—248
KFQX	Alfred M. Hubbard,	Seattle, Wash.	250—233
KFSG	Echo Park Evangelistic Association,	Los Angeles, Calif.....	500—278
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Ore.....	50—360
KGO	General Electric Co.,	Oakland, Calif. .....1000—312	
KGU	Marion A. Mulrony,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHQ	Louis Wasmer,	Seattle, Wash..	100—360
KJFU	Central Power Co.,	Kearney, Neb.	10—234
KJQ	C. O. Gould,	Stockton, Calif...	5—273
KJR	Northwest Radio Service,	Seattle, Wash.	100—270
KJS	Bible Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—509
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—283
KMJ	San Joaquin Lt. & Power Corp.,	Fresno, Calif.	50—248
KMO	Love Electric Co.,	Tacoma, Wash.	10—360
KNT	Walter Hemrich,	Kukak Bay, Alaska	100—263
KNX	Electric Lighting Supply Co.,	Los Angeles, Calif.	100—360
KOB	New Mexico College of Agriculture and Mechanic Arts, State	College, N. M.	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Cal.	500—423
KQP	Apple City Radio Club,	Hood River, Ore.....	10—360
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Pa.	500—270
KQW	Chas. D. Herrold,	San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—275
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KTW	First Presbyterian Church,	Seattle, Wash.	750—360
KUO	Examiner Printing Co.,	San Francisco, Calif.	150—360
KUY	Coast Radio Co.,	El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co.,	Stockton, Calif.....	50—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	250—360
KYQ	Electric Shop,	Honolulu, Hawaii	100—270
KYW	Westinghouse Electric & Mfg. Co.,	Chicago, Ill.....	1000—536
KZM	Preston D. Allen,	Oakland, Calif.	100—360
WAAB	Valdemar Jensen,	New Orleans, La.	100—268
WAAC	Tulane University,	New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal,	Chicago, Ill.	200—286
WAAM	I. R. Nelson Co.,	Newark, N. J.	250—263
WAAN	University of Missouri,	Columbia, Mo.	50—25[illegible]



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NORTH DAKOTA HEARS CUBA
"Miraco has been working fine. Have heard from coast to coast. Also many stations in Canada, Hawaii and Cuba."—T. G. Anderson, Turtle Lake, N. D.

OHIO HEARS PORTLAND, ORE.
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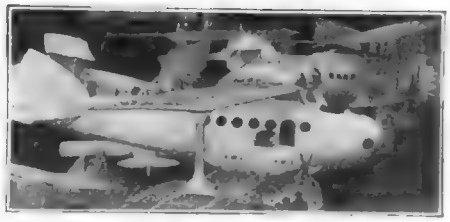
WAAW	Omaha Grain Exchange,	Omaha, Neb.	500—286
WABB	Harrisburg Sporting Goods Co.,	Harrisburg, Pa.	10—266
WABD	Parker High School,	Dayton, Ohio	5—283
WABE	Young Men's Christian Association,	Washington, D. C.	100—283
WABH	Lake Shore Tire Co.,	Sandusky, Ohio	10—240
WABI	Bangor Railway & Electric Co.,	Bangor, Maine	100—240
WABL	Connecticut Agricultural College,	Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co.,	Saginaw, Mich.	100—254
WABN	Ott Radio, Inc.,	LaCrosse, Wis.	500—244
WABO	Lake Ave. Baptist Church,	Rochester, N. Y.	10—283
WABP	Robert F. Weinig,	Dover, Ohio	100—266
WABQ	Haverford College Radio Club,	Haverford, Pa.	50—261
WABR	Scott High School,	Toledo, Ohio	50—270
WABT	Holliday-Hall,	Washington, Pa.	100—252
WABU	Victor Talking Machine Co.,	Camden, N. J.	50—226
WABW	College of Wooster,	Wooster, Ohio	20—234
WABX	Henry B. Joy,	Mount Clemens, Mich. (near)	500—270
WABY	John Magaldi, Jr.,	Philadelphia, Pa.	50—242
WABZ	Coliseum Place Baptist Church,	New Orleans, La.	50—263
WBAA	Purdue University,	West Lafayette, Ind.	250—283
WBAH	The Dayton Co.,	Minneapolis, Minn.	1000—417
WBAN	Wireless Phone Corporation,	Paterson, N. J.	100—244
WBAO	James Millikin University,	Decatur, Ill.	50—360
WBAP	Wortham-Carter Publishing Co. (Star-Telegram),	Fort Worth, Texas	750—476
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	500—423
WBAX	John H. Stenger, Jr.,	Wilkes-Barre, Pa.	20—360
WBAY	The Western Electric Co.,	N. Y.	500—492
WBBA	Newark Radio Laboratories,	Newark, Ohio	10—240
WBBD	Barbey Battery Service,	Reading, Pa.	50—234
WBBG	Irving Vermilya,	Mattapoisett, Mass.	500—248
WBBH	J. Irving Bell,	Port Huron, Mich.	50—246
WBBL	Grace Covenant Church,	Richmond, Va.	5—283
WBBM	Frank Atlas Produce Co.,	Lincoln, Ill.	200—226
WBBN	A. B. Blake,	Wilmington, N. C.	10—275
WBBP	Petoskey High School,	Petoskey, Mich.	100—246
WBBR	Peoples Pulpit Association,	Rossville, N. Y.	500—273
WBBT	Lloyd Brothers,	Philadelphia, Pa.	5—234
WBBU	Jenks Motor Sales Co.,	Monmouth, Ill.	10—224
WBBV	Johnstown Radio Co.,	Johnstown, Pa.	5—248
WBBW	Ruffner Junior High School,	Norfolk, Va.	50—222
WBBY	Washington Light Infantry,	Charleston, S. C.	10—268
WBBZ	Noble B. Watson,	Indianapolis, Ind.	50—227
WBL	T. & H. Radio Co.,	Anthony, Kansas	100—254
WBS	D. W. May (Inc.),	Newark, N. J.	50—360
WBT	Southern Radio Corp.,	Charlotte, N. C.	250—360
WBZ	Westinghouse Electric & Mfg. Co.,	Springfield, Mass.	1000—337
WCAD	St. Lawrence University,	Canton, N. Y.	250—280
WCAE	Kaufman & Baer Co.,	Pittsburgh, Pa.	500—462
WCAG	Clyde R. Randall,	New Orleans, La.	100—268
WCAH	Entrekin Electric Co.,	Columbus, Ohio	100—286
WCAJ	Nebraska Wesleyan University,	University Place, Neb.	500—283
WCAK	Alfred P. Daniel, Asst. Division Mgr.,	A. R. R. L., Houston, Texas	10—263
WCAL	St. Olaf College,	Northfield, Minn.	500—360
WCAO	The Sanders and Stayman Co.,	Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D. C.	500—469
WCAR	Southern Radio Corp. of Texas,	San Antonio, Texas	100—360
WCAS	Wm. Hood Dunwoody Industrial Institute,	Minneapolis, Minn.	100—280
WCAT	South Dakota State School of Mines,	Rapid City, S. D.	50—240



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PACKET E

Radio Amateurs Practical Design Data

A complete simplified, practical compilation of the following: Measurement Charts, Special Hartley and Navy Circuits for Receiving Sets, Five Watt Transmitter, Reinartz Tuner, 15 Watt C.W. Transmitter, Wavelengths of Inductance Coils, Two Special Tables of Oscillation, and Chart of Antenna Characteristics. Contained in a handsome folder size 9x12.

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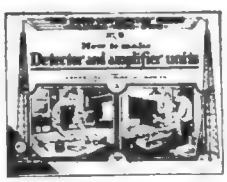

PATTERN No. 2

Detector and Amplifier Units

An interesting, valuable method of construction showing clearly and simply how to make efficient Vacuum Tube Detector and Amplifier Units to be used with any type of receiver. Folder contains two four-page instruction sheets and three blueprints 11"x16" covering every detail in the making of Detector and Amplifier Units.

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PACKET C

All About Aerials

The Aerial is a very vital part of any radio receiver and to know which are the most efficient for the various types of receivers is a great help to any constructor. The CONSRAD folder on aerials is complete, giving diagrams and illustrations of the various types of aerials, their value and their application.

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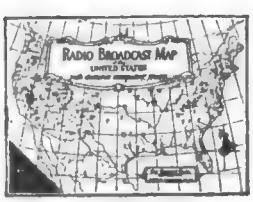

PACKET A

Radio Broadcast Map

Completeness is the predominant feature of the CONSRAD broadcast map. Not only does it show the accurate location of broadcast stations in the United States, but it is arranged so that you can accurately measure the distance of any station from your home. It is printed on cloth so that you can tack it on the wall and keep it in sight at all times. It will not tear under usage and remains ready for use at all times.

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Call Letters	Name	Location	Power & Wave Length
WHN	George Schubel,	Loew's State Theatre Bldg., New York, N. Y.	500—360
WHO	Bankers Life Co.,	Des Moines, Iowa	500—526
WIAB	Art A. Johnson's	Garage, Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Philadelphia, Pa.	100—254
WIAK	Journal-Stockman Co.,	Omaha, Neb.	250—278
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAS	Home Electric Co.,	Burlington, Iowa	100—283
WIK	K & L Electric Co.,	McKeesport, Pa.	100—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	5—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAB	American Electric Co.,	Lincoln, Neb.	100—229
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—283
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAR	The Outlet Co. (J. Samuels & Bro.),	Providence, R. I.	500—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	250—286
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	20—268
WJD	Denison University,	Granville, Ohio	10—229
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	50—278
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	20—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	50—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	500—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKBF	Dutee W. Flint,	Cranston, R. I.	500—286
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	100—360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	100—234
WLAL	Naylor Electrical Co. (Sim Naylor),	Tulsa, Okla.	100—360
WLAP	W. V. Jordan,	Louisville, Ky.	20—286
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—283
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnm Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	5—360
WLBL	Wisconsin Department of Markets,	Stevens Point, Wis.	500—278
WLS	Sears, Roebuck & Co.,	Chicago, Ill.	500—345
WLW	Crosley Radio Corp.,	Cincinnati, Ohio	500—423
WMAC	Clive B. Meredith,	Cazenovia, N. Y.	100—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254
WMAK	Norton Laboratories,	Lockport, N. Y.	500—273
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	100—261
WMC	Commercial,	Memphis, Tenn.	500—500
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	100—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	50—360
WNAL	Omaha Central High School,	Omaha, Nebr.	20—258
WNAP	Wittenberg College,	Springfield, Ohio	100—275
WNAR	First Christian Church,	Butler, Mo.	20—231
WNAT	Lennig Bros. Co. (Fred'k Lennig),	Philadelphia, Pa.	100—360

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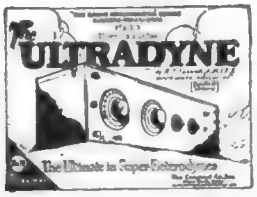
"ULTRA" Radio Reception



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Call Letters	Name	Location	Power & Wave Length
WNAW	Henry Kunzman,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNYC	City of New York,	New York, N. Y.	1000—526
WOAC	Page Organ Co. (H. P. Mouse),	Lima, Ohio	50—266
WOAE	Midland College,	Fremont, Neb.	15 —280
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAG	Apollo Theatre (Belvidere Amusement Co.),	Belvidere, Ill.	100—273
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	10—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	200—360
WOAO	Lyradion Mfg. Co.,	Mishawaka, Ind.	50—360
WOAT	Boyd M. Hamp,	Wilmington, Del.	100—360
WOAV	2nd Battalion, 112th Inf.,	P. N. G., Erie, Pa.	50—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument Pottery Co.),	Trenton, N. J.	500—240
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	500—360
WOO	John Wanamaker,	Phila., Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	100—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	100—268
WPAK	North Dakota Agricultural College,	Agricultural College, N.D.	50—283
WPAL	Avery & Loeb Electric Co.,	Columbus, Ohio	500—286
WPAM	Auerbach & Guettel,	Topeka, Kan.	100—275
WPAR	Ward Battery & Radio Co.,	Beloit, Kan.	10—236
WPAU	Concordia College,	Moorhead, Minn.	10—286
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	10—273
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—360
WQAC	E. B. Gish,	Amarillo, Texas	100—234
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio	5—240
WQAI	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—283
WQAN	Scranton Times,	Scranton, Pa.	50—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Tex.	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAX	Radio Equipment Co.,	Peoria, Ill.	100—248
WQJ	Calumet Baking Powder Co.,	Chicago, Ill.	500—448
WRAF	The Radio Club (Inc.),	Laporte, Ind.	10—224
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAM	Lombard College,	Galesburg, Ill.	100—244
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—236
WRAO	St. Louis Radio Service Co.,	St. Louis, Mo.	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—242
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Flexons Garage,	Gloucester City, N. J.	100—268
WRBC	Immanuel Lutheran Church,	Valparaiso, Ind.	500—278
WRC	Radio Corp. of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	30—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N. Y.	500—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence, R. I.	100—261

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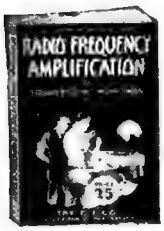

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Don't struggle in the dark, looking for stations—here is an inexpensive book that gives you detailed instructions on just how to handle your Radio set. You will be surprised at the increased results that can be obtained through proper tuning.

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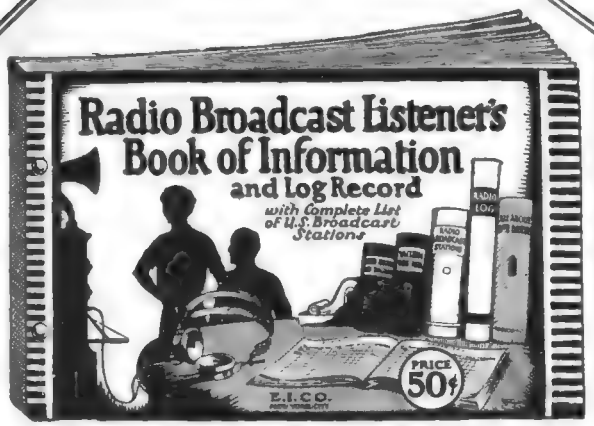

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The Instant Reference book giving essential Radio Information, List of Broadcast Stations, Log Record, Etc.

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The book is enclosed in a handsome two-color cover, bound in Loose-leaf fashion, so that new pages can be inserted if necessary. It contains 80 pages, each one containing information more valuable than the last. The following is a brief summary of the information contained in this book:

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Radio Batteries: **Wireless code chart:**
Station log Chart:

Complete List of Broadcast Stations of the United States, giving Power, wave length, and Time of Operation each day of the week.

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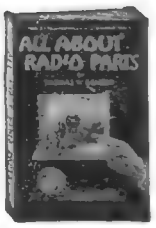
Book No. 7



Everyone who constructs a radio set should know, before he starts, the simple fundamentals of the various parts that go to make up the set. The E. I. Company has set these forth in a compact little book that is valuable at all times.

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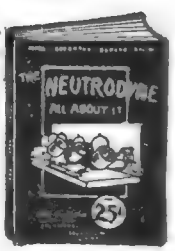
Book No. 8

The Vacuum Tube is a marvelous piece of apparatus. A short study of it as given in this book gives you the principal on which every Vacuum Tube Radio Receiver operates.

PRICE 25c

Book No. 9



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Book No. 12

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WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	250—360
WSAN	Allentown Radio Club,	Allentown, Pa.	10—229
WSAP	Seventh Day Adventist Church,	New York, N. Y.	250—263
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	100—254
WSAU	Camp Marienfeld,	Chesham, N. H.	10—229
WSAV	Clifford W. Vick Radio Construction Co.,	Houston, Texas	100—360
WSAY	Irving Austin (Port Chester Chamber of Commerce),	Port Chester, N. Y.	100—233
WSAZ	Chase Electric Shop,	Pomeroy, Ohio	50—258
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSL	J. & M. Electric Co.,	Utica, N. Y.	10—273
WSOE	School of Engineering of	Milwaukee, Wis.	100—246
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	100—266
WTAC	Penn. Traffic Co.,	Johnstown, Pa.	150—275
WTAF	Louis J. Gallo,	New Orleans, La.	10—268
WTAG	Kern Music Co.,	Providence, R. I.	10—258
WTAJ	The Radio Shop,	Portland, Me.	10—236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10—252
WTAM	Willard Storage Battery Co.,	Cleveland, Ohio	1000—390
WTAP	Cambridge Radio & Elec. Co.,	Cambridge, Ill.	50—242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100—254
WTAR	Reliance Elec. Co.,	Norfolk, Va.	100—280
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500—286
WTAT	Edison Electric Illuminating Co.,	Boston, Mass. (portable)	100—244
WTAU	Ruegg Battery and Electric Co.,	Tecumseh, Neb.	10—242
WTAW	Agricultural & Mechanical College,	College Station, Texas	250—280
WTAX	Williams Hardware Co.,	Streator, Ill.	50—231
WTAY	Oak Leaves Broadcasting Station,	Oak Park, Ill.	500—283
WTAZ	Thomas J. McGuire,	Lambertville, N. J.	15—283
WTG	Kansas State Agricultural College,	Manhattan, Kan.	50—273
WTL	H. G. Saal Co.,	Chicago, Ill., Webster Hall	10—268
WWAB	Hoenig, Swern & Co. (John Rasmussen),	Trenton, N. J.	10—226
WWAD	Wright & Wright, Inc.,	Philadelphia, Pa.	100—360
WWAE	L. J. Crowley,	Joliet, Ill.	500—227
WWAO	Michigan College of Mines,	Houghton, Mich.	250—244
WWI	Ford Motor Co.,	Dearborn, Mich.	250—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517
WWL	Loyola University,	New Orleans, La.	5—280

CANADIAN STATIONS

CFAC	The Calgary Herald,	Calgary, Alta.	— 430
CFCA	Star Publishing & Printing Co.,	Toronto, Ont.	— 400
CFCF	Marconi Wireless Telegraph Co. of Canada,	Montreal, Que., Canada	— 440
CFCH	Abitibi Power & Paper Co.,	Iroquois Falls, Ont.	— 400
CFCJ	La Cie. de L'Evenement,	Quebec, P. Q.	— 410
CFCK	Radio Supply Co., Ltd.,	Edmonton, Alta.	— 410
CFCL	Centennial Methodist Church,	Victoria, B. C.	— 400
CFCN	W. W. Grant Radio, Ltd.,	Calgary, Alta.	— 440
CFCO	Semmelhaack-Dickson, Ltd.,	Bellevue, Que.	— 450
CFCQ	Radio Specialties, Ltd.,	Vancouver, B. C.	— 450
CFCR	Laurentide Air Service, Ltd.,	Sudbury, Ont.	— 410
CFCW	The Radio Shop,	London, Ont.	— 420
CFDC	Sparks Co.,	Nanaimo, B. C.	— 430
CFQC	The Electric Shop, Ltd.,	Saskatoon, Sask.	— 400
CFRC	Queens University,	Kingston, Ont.	— 450
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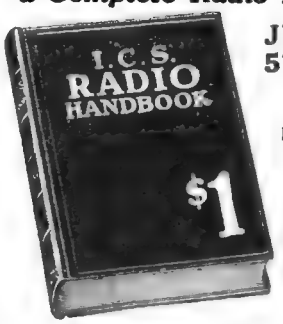

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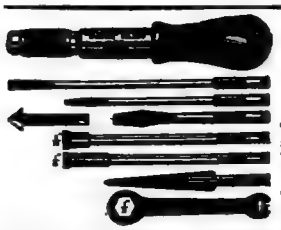

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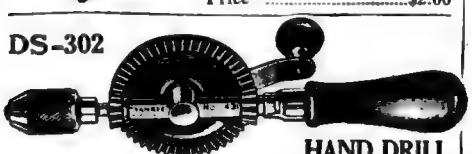

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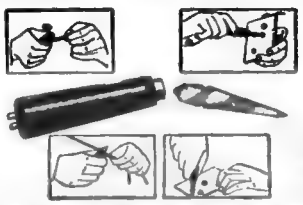

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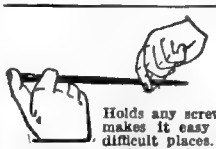

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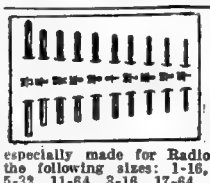

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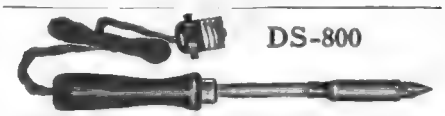

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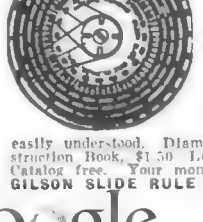

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CHCL	The Vancouver Merchants Exchange, Ltd.,	Vancouver, B. C.	440
CHCM	Riley & McCormack, Ltd.,	Calgary, Alta.	440
CHCS	The Hamilton Spectator,	Hamilton, Ont.	410
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CJCI	Maritime Radio Corp., Ltd.,	St. John, N. B.	400
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CJCX	Percival W. Shackleton,	Olds, Alta.	400
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CKCH	Canadian National Railways,	Ottawa, Ont.	435
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CKYC	V. W. Odlum,	Vancouver, B. C.	400

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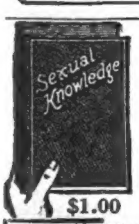

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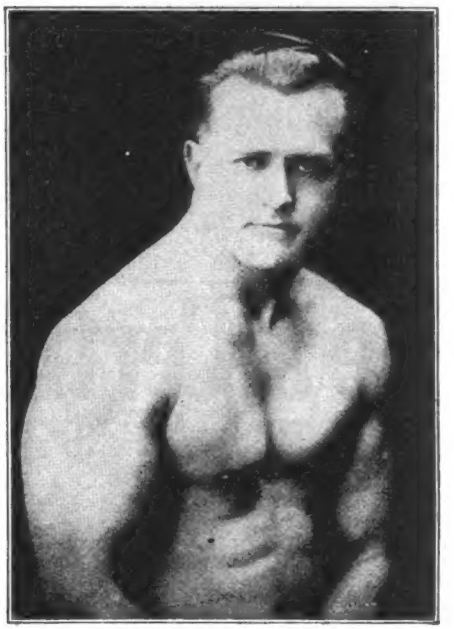

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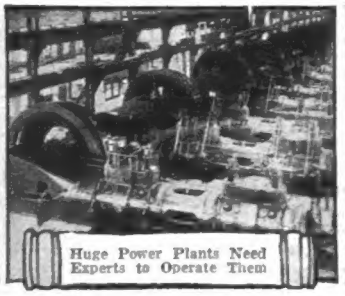
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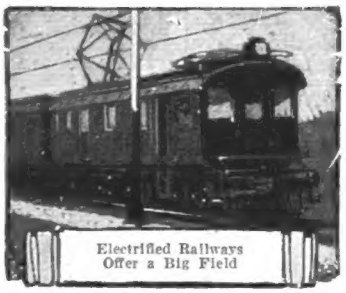
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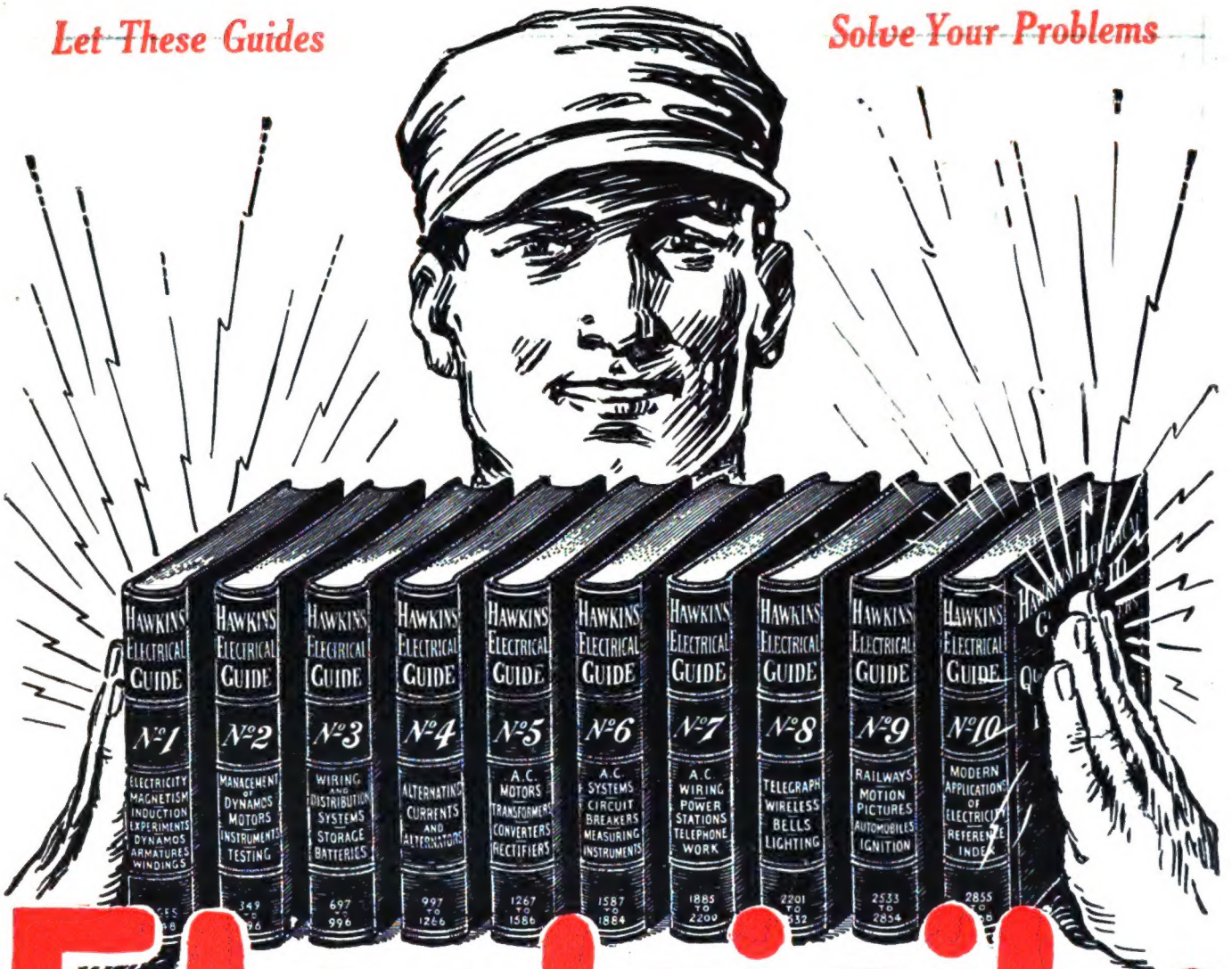

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